After-sales Service Instructions

Repairs

12

VDT-W-120/100 En
Suppl. 1
Ed. 1

Rectifiers

with press-in diodes
on T1-Alternators 0120 6005..

BOSCH After-sales Service
Automotive
Equipment

A 1

A1

This publication has been designed with the forth-coming change-over to microfilm in mind.

When a publication has been transferred to microfilm, the screen will be filled completely by a quarter of a publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference in constantly being made to a particular illustration.

Until the change-over to microfilm, we have slightly reduced the size of the print and of the illustrations.

Automotive Equipment - After-Sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1

Published by: After-Sales Service
Department for Training and Technology (KH/VSK)
Please direct questions and comments concerning the contents to our authorized representative in your country.

Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne
par Robert Bosch GmbH.

Suppl.1

Contents

Testers

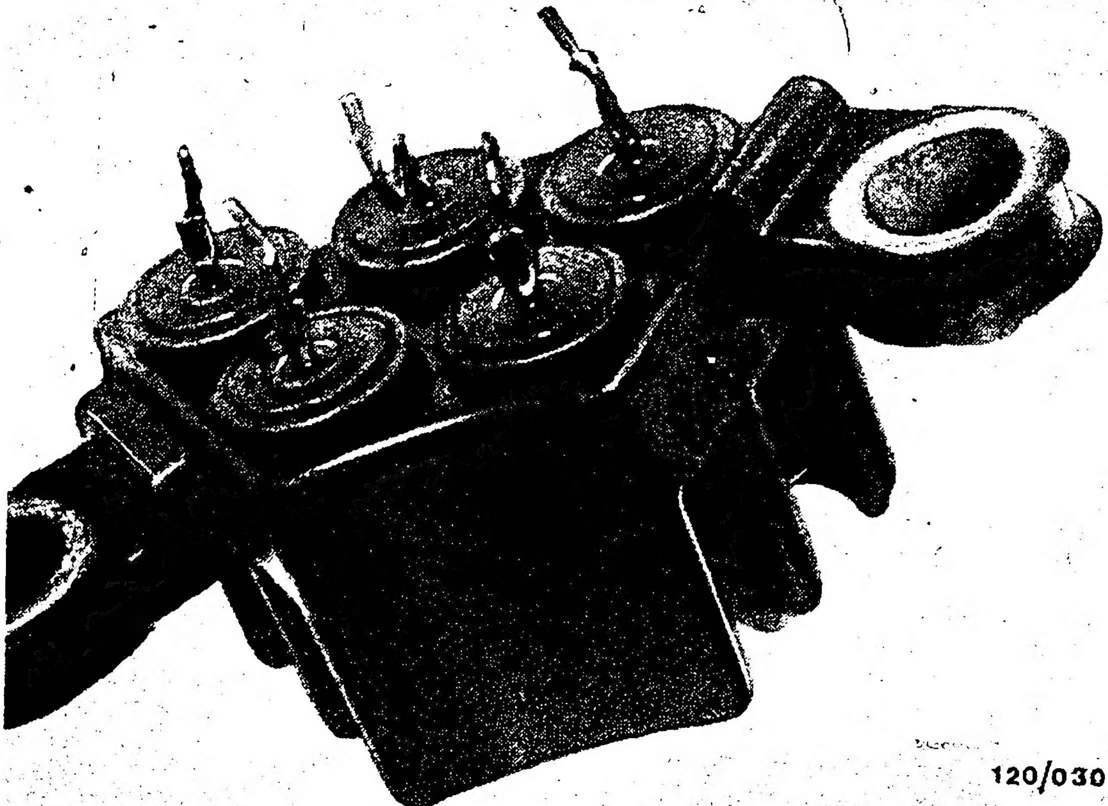
Alternator tester	EFAW 192	0 681 101 403
or	WPG 012:00	0 684 201 200

Tools

Arbor press	commercially available
Soldering iron 180 W	commercially available
Press-in mandrel	KDLJ 64 99/0/2
Clamping device	KDLJ 60 08
Puller	KDLJ 60 07

Materials

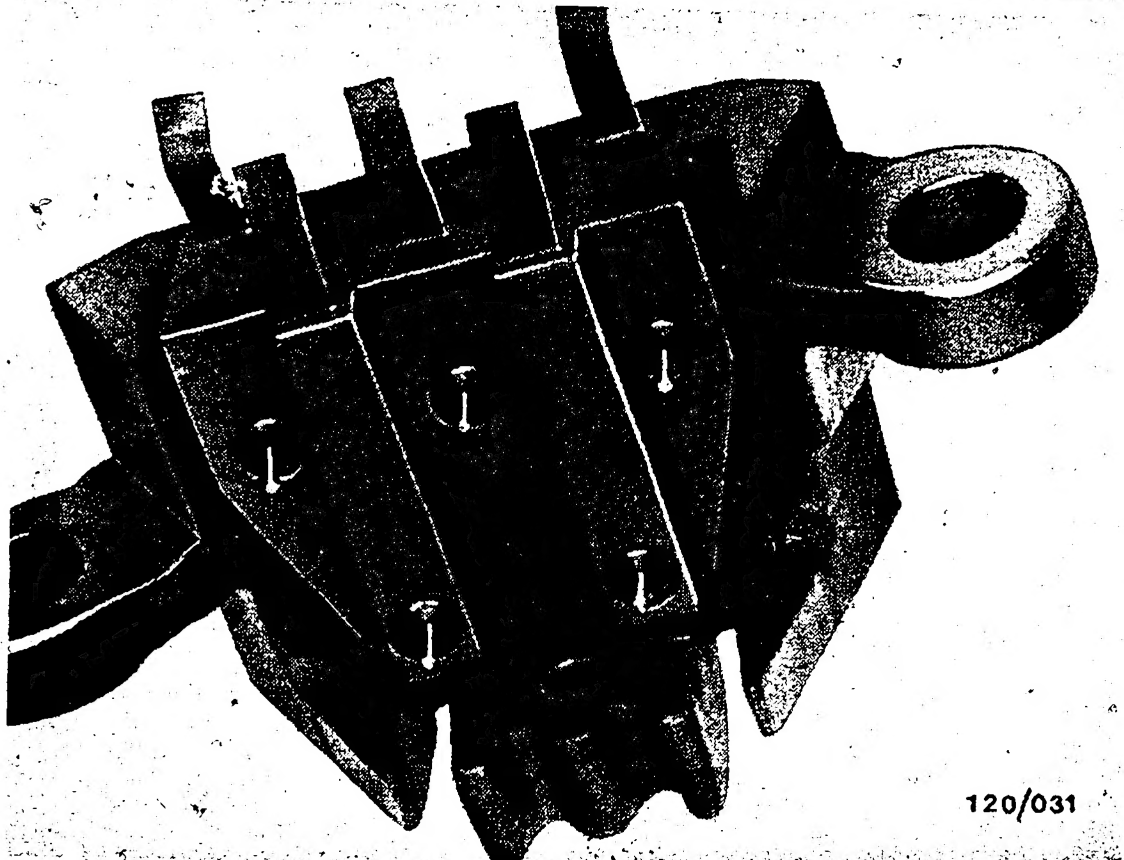
Electro insulating spray (clear) No. 1532	3M Company
or	
Finishing varnish	Commercially available



120/030

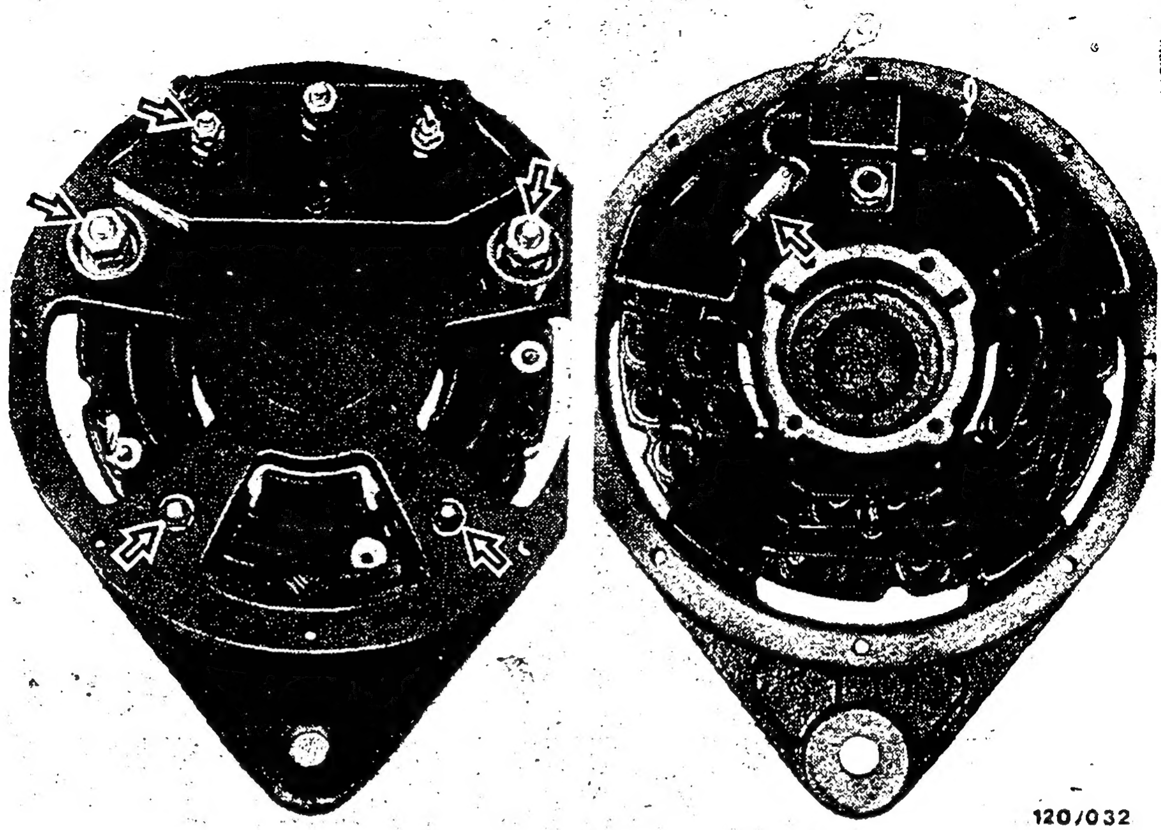
<u>Conversion of the rectifiers from Siemens to Bosch diodes</u>

The heat sink shown is fitted with Siemens diodes pressed in from above. The diode connections are soldered to the joining bars.
The Siemens diodes used up to now (2 127 320 018 and 019) are no longer available.
If the Siemens diode in such a heat sink is defective, the complete heat sink is to be replaced by the heat sink 2 125 715 061 which is fitted with Bosch diodes.



120/031

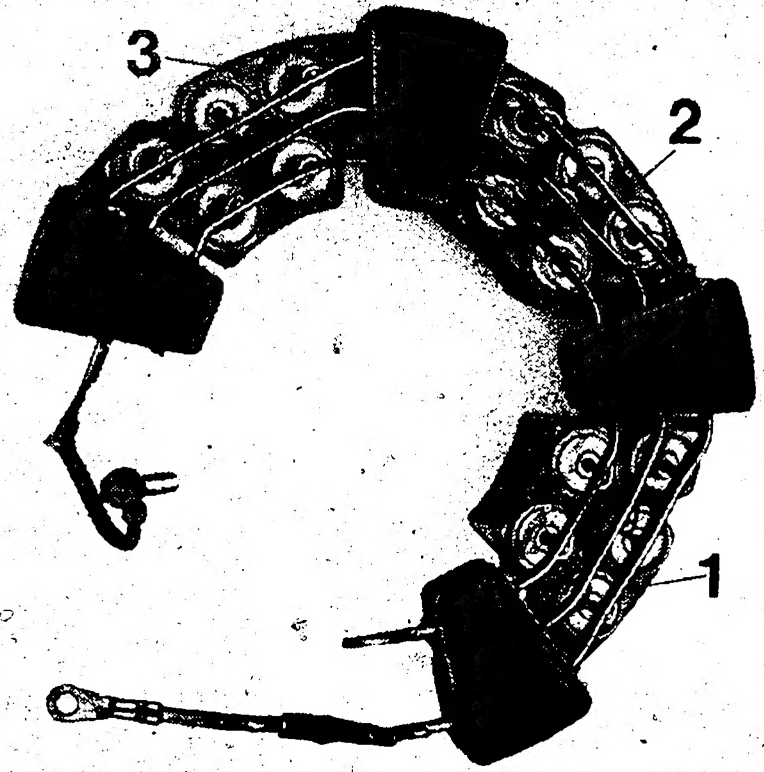
Heat sink fitted with Bosch diodes.
Diodes pressed in from outside. Diode connections soldered to the heat-sink joining bars.



120/032

Removing the rectifiers

Remove the fastening screws from the terminal studs B+, D- and D+, and from the rectifier assembly (left-hand figure - arrow).
On the inside of the rectifier (right-hand picture - arrow), pull off the capacitor connection from the rectifier.
Remove the rectifier assembly from the end shield.

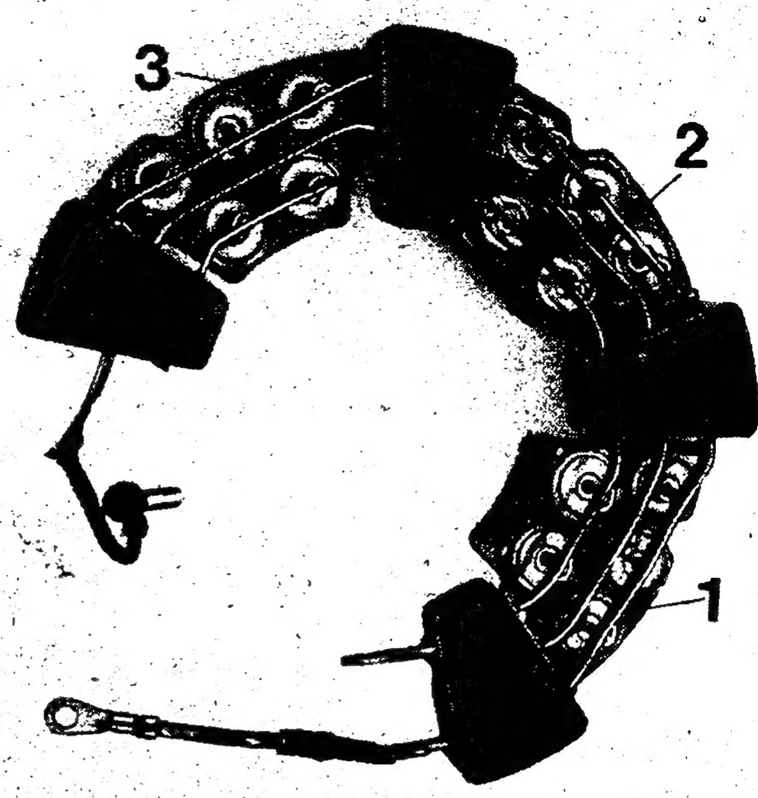


120/033

Removal of a heat sink fitted with Siemens diodes

The rectifier assembly is comprised of 3 heat sinks with diodes. Heat sinks 1 and 2 are fastened with common screws, as are heat sinks 2 and 3.
If a diode is defective in a heat sink, the heat sink concerned must be removed as follows:

Cut the diode connections from the heat sink concerned at the soldering lugs of the one-piece joining bars. Use sidecutters.



Defective diode in heat sink 1

Remove heat sink.

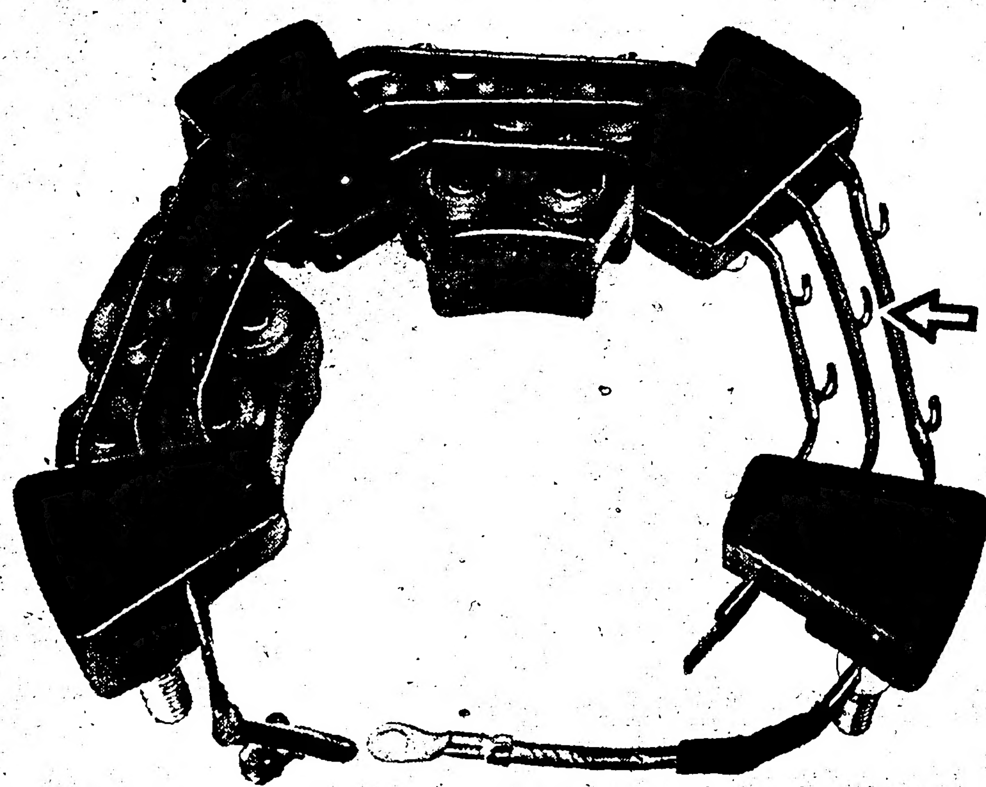
Defective diode in heat sink 2

Unsolder the diode connections from heat sink 1 and use pointed pliers to bend up the terminal lugs at the joining bars.
Remove heat sinks 1 and 2.

Defective diode in heat sink 3

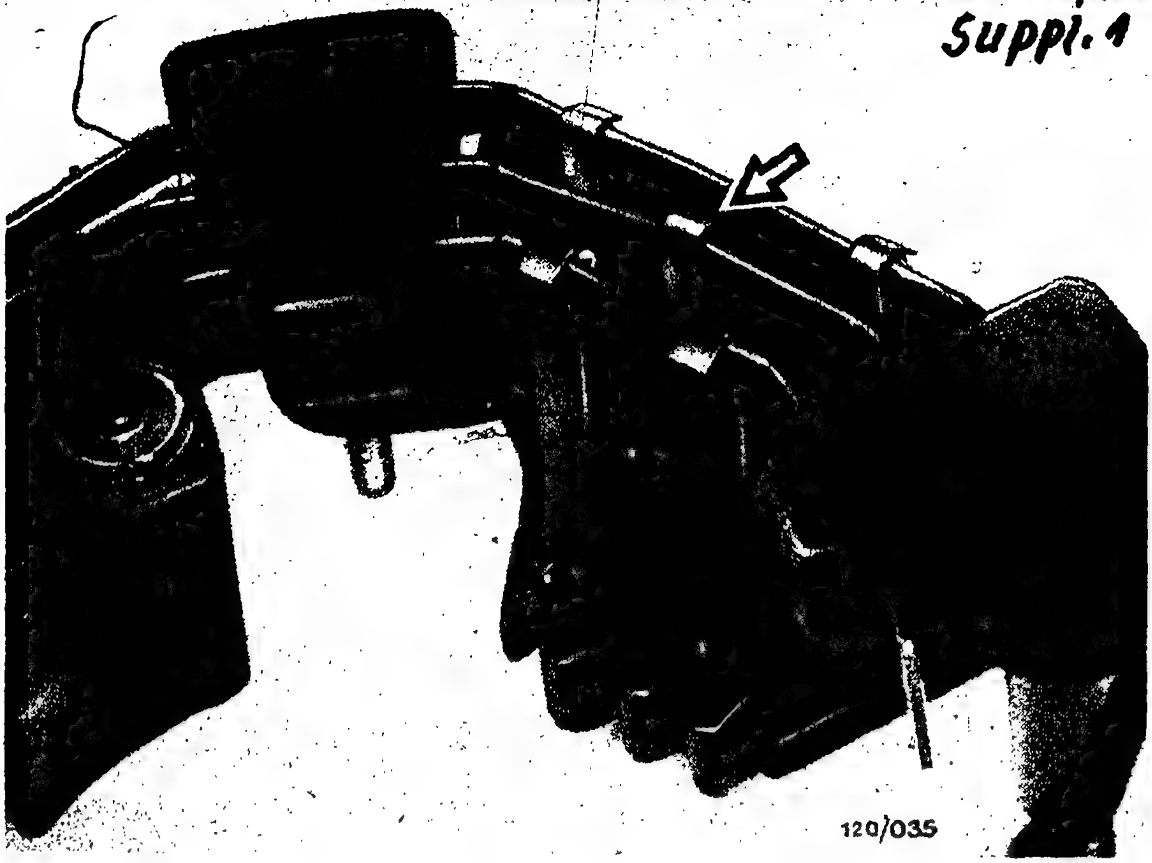
Unsolder the diode connections from heat sinks 1 and 2, with pointed pliers bend up the terminal lugs at the joining bars.

Remove heat sinks 1, 2 and 3.



120/034

Before fitting a heat sink equipped with Bosch diodes, the soldering lugs must be bent up against the joining bars (arrow).



120/035

Fitting the heat sinks

Install the heat sinks and secure with the common screws.

Heat sinks with Bosch diodes: Don't forget the insulating washers.

Bend the heat-sink joining bars over the common joining bars of the rectifier at an angle of about 120° and solder (arrow).

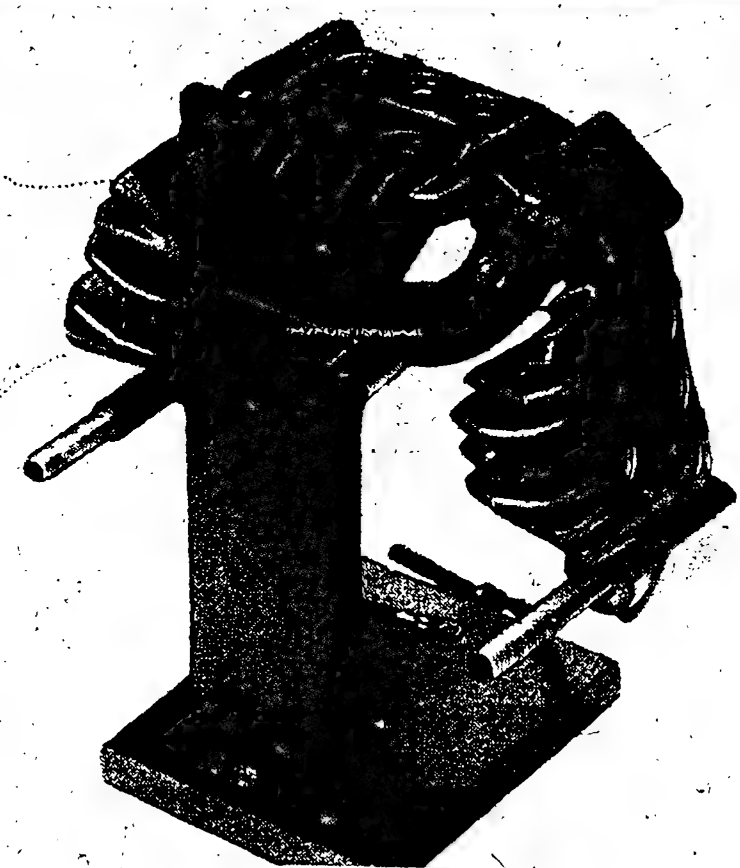
Heat sinks with Siemens diodes: Solder the diode connections to the soldering lugs on the joining bars.

Fit the rectifier assembly into the end shield.

Fastening-screw tightening torques		2.4	...	3.2 Nm
	B+ bolts	10.0	...	13.0 Nm
	BE bolts	10.0	...	13.0 Nm
	D+ bolts	2.4	...	3.2 Nm

All bright areas on collector-ring end shield, heat sinks, diodes and joining bars are to be coated with finishing varnish or insulating spray (electric). The ball bearing seat is to be greased with Ft 70 v 1.

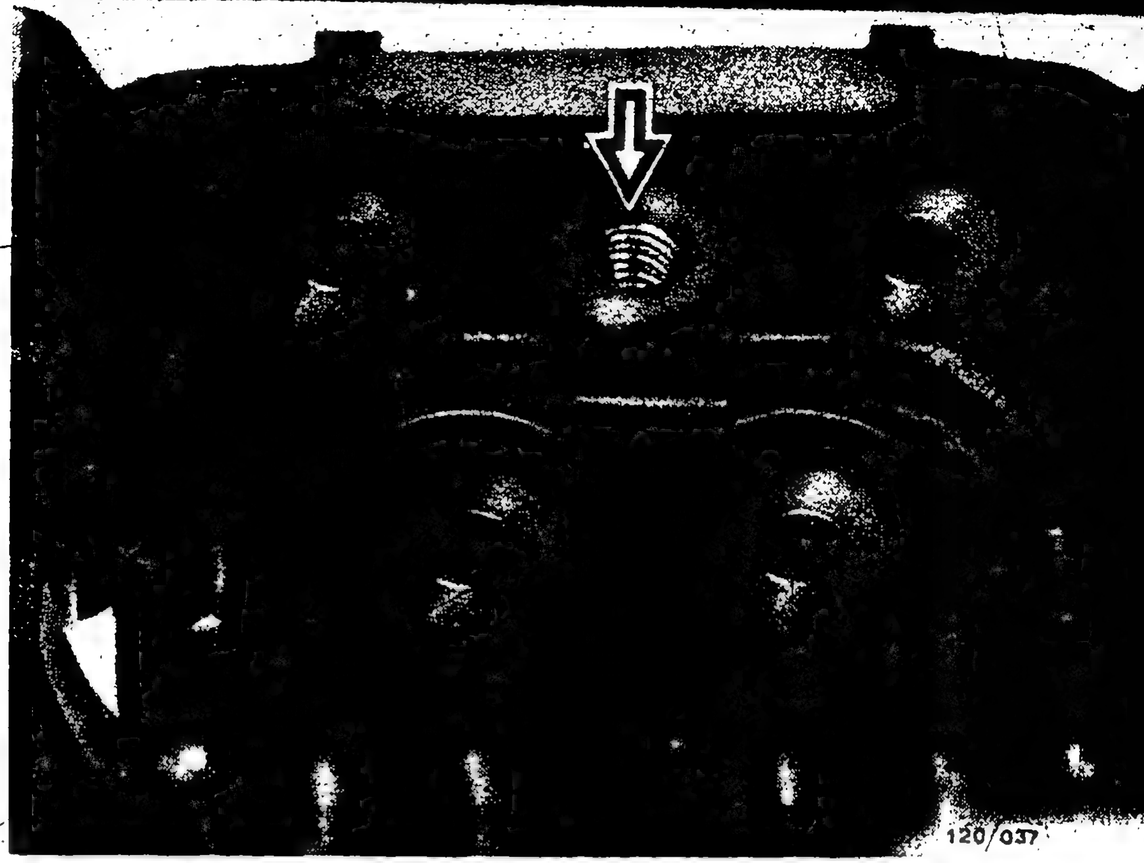
After conversion, check the functioning of the rectifier with an alternator tester.



120/036

Replacing the diodes on heat sinks fitted with Bosch diodes

Clamp the rectifier assembly in the clamping device KDLJ 6008 so that the heat sink with the defective diode is pointing upwards. When fitting, use the fastening parts supplied.

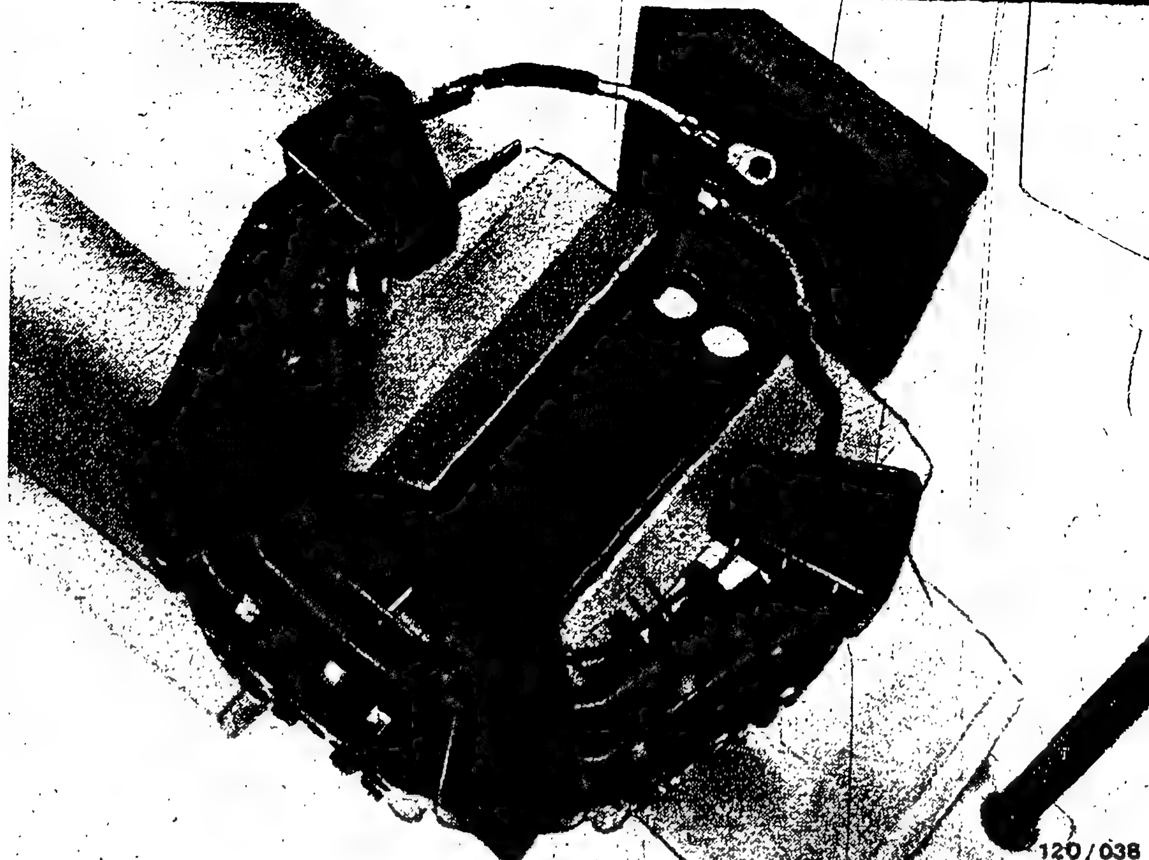


120/037

Removal of a defective Bosch diode

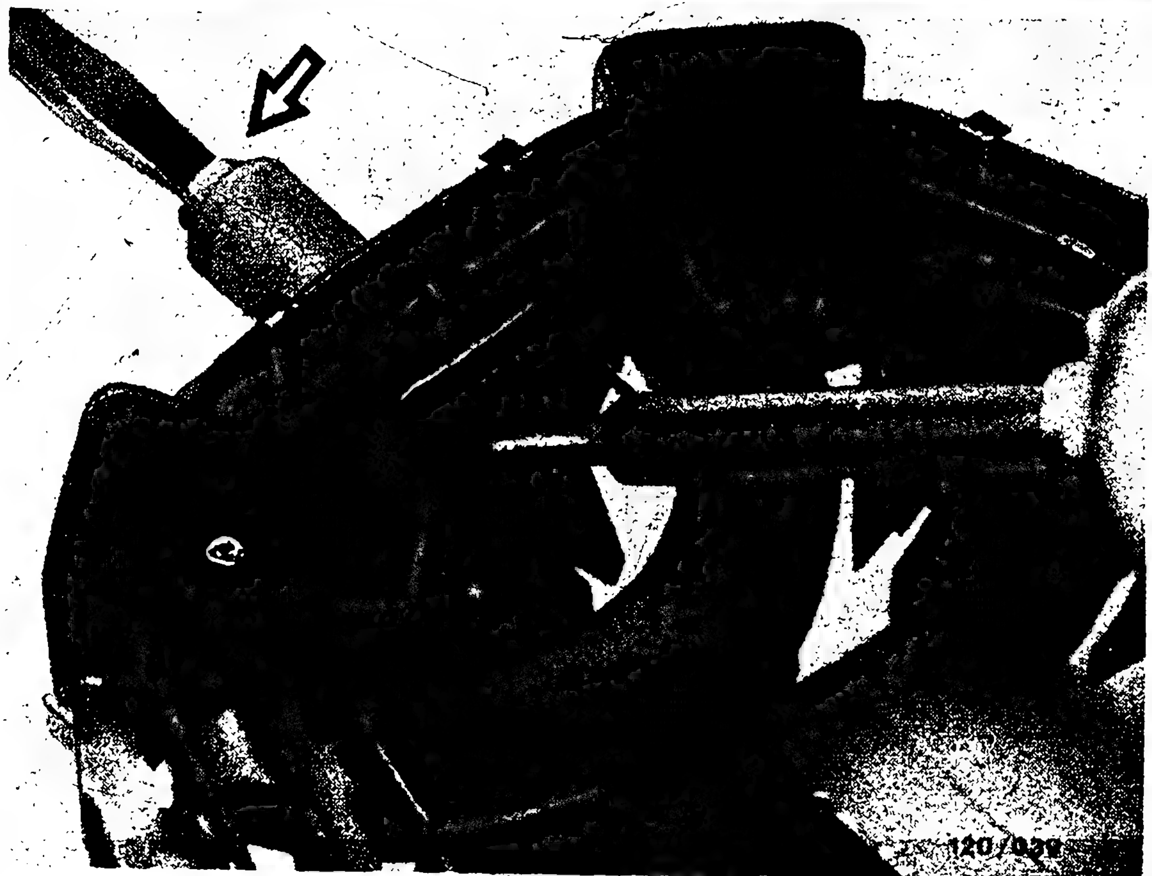
Drill out the diode: Hole diameter 4 mm
Hole depth 10 mm

Cut an M5 thread in the diode (arrow).

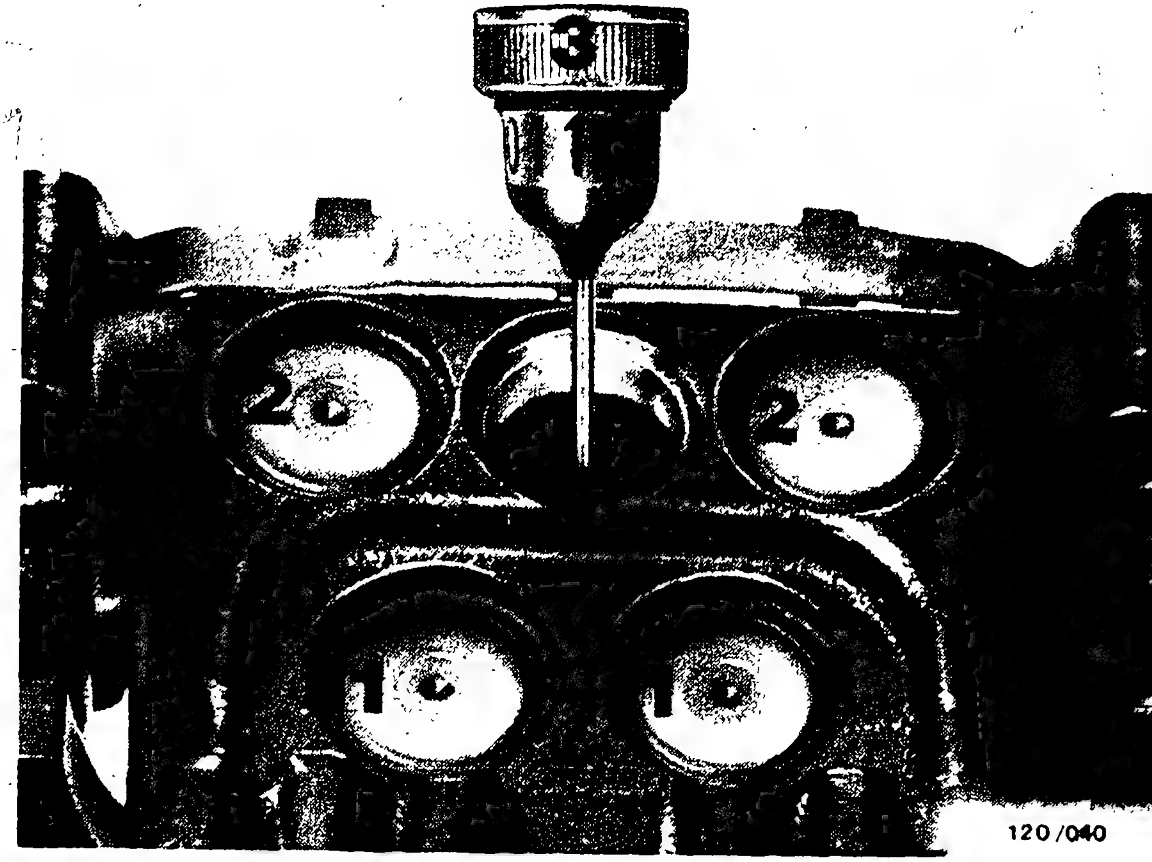


120/038

Clamp the clamping device KDLJ 6008 in the vise (Fig.).



Apply the puller KDLJ 6007 to the diode and screw it in (arrow).
Using the soldering iron, heat up the diode connections to the joining bars and then use a screwdriver and the puller together to remove the diode.

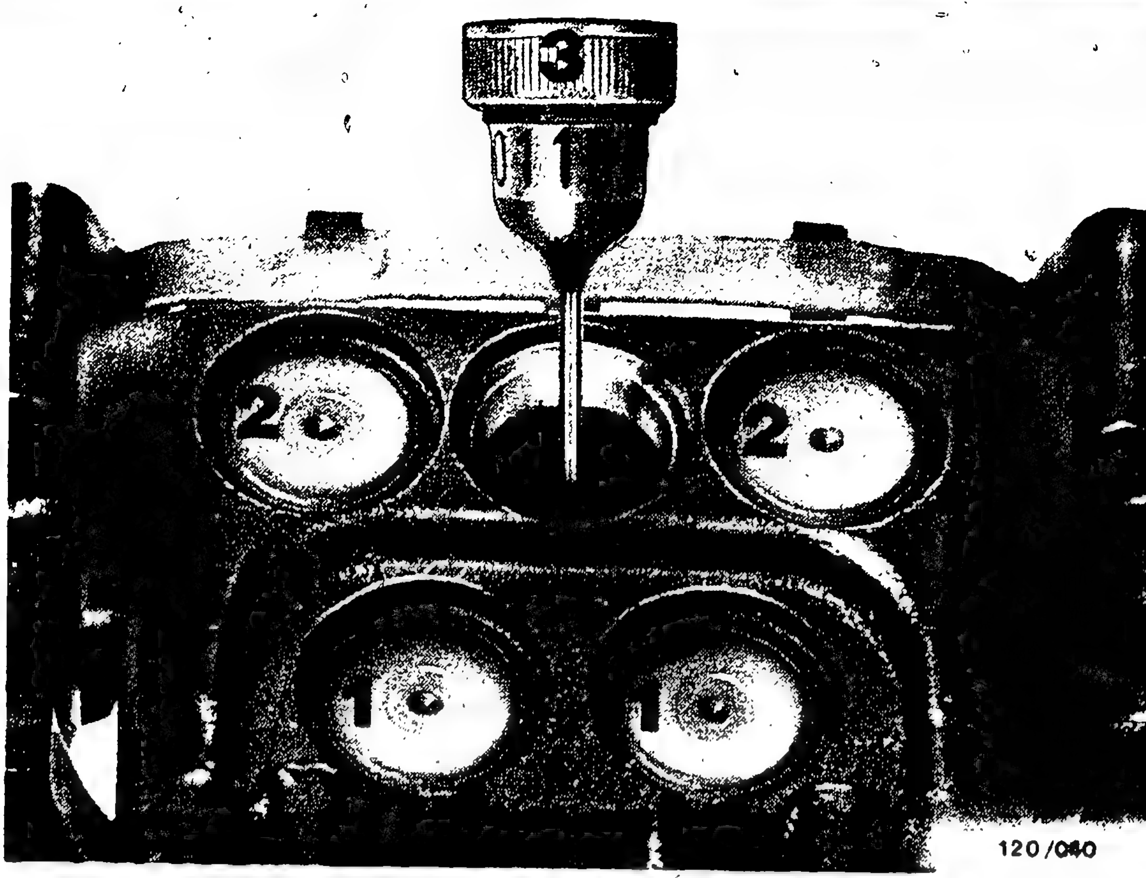


1 - Positive diodes
2 - Negative diodes
3 - Exciter diodes

Pressing-in a Bosch diode

Caution: When pressing-in new diodes take care that the positive, negative and exciter diodes are not mixed up.

The pressed-out positive and exciter diodes are to be replaced by the Bosch diode 0 270 100 118, and the negative diode by the Bosch diode 0 270 100 117.



120/040

Clamp the rectifier assembly in the clamping device KDLJ 6008. Using the press-in mandrel 6499/0/2 and an arbor press, press the Bosch diode into the heat sink.

Solder the diode terminal to the heat-sink joining bars. After replacing the diode, check the functioning of the rectifier with an alternator tester.

New Product

0 120 689 502 – T 1 – 28 V 95 A 16
Alternator with
0 192 053 001 – EE 28 V 3
Attached-type transistor regulator

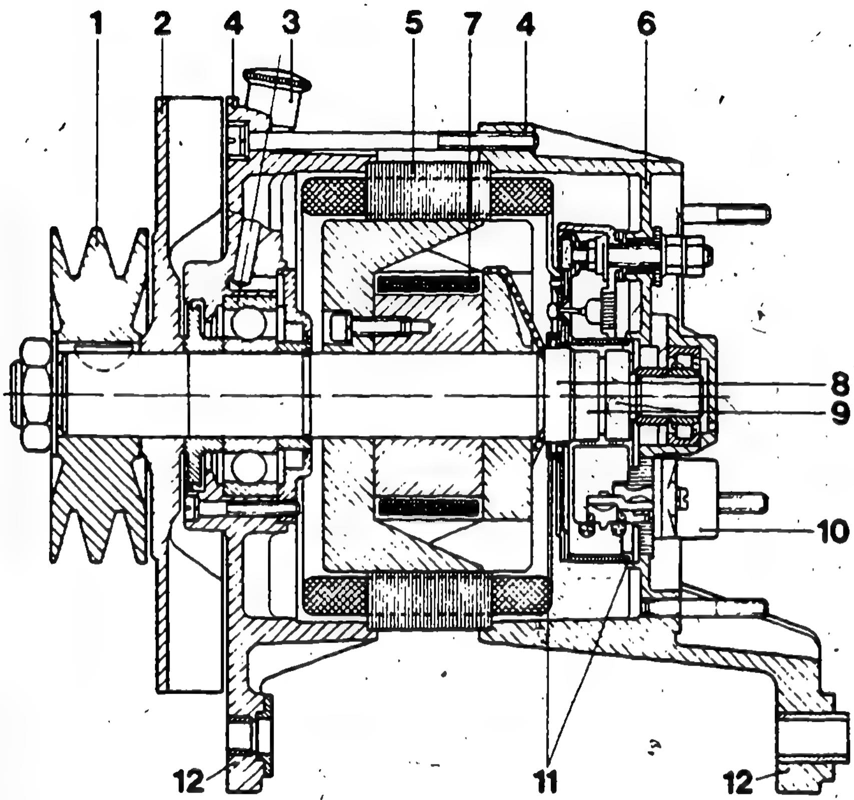


Fig. 1
Alternator section drawing

1 = 2-groove pulley
2 = Fan
3 = Grease cup
4 = End shield
5 = Stator core
6 = Collector-ring end shield
7 = Excitation winding
8 = Seal ring
9 = Collector ring
10 = Attached-type transistor regulator EE 28 V 3
11 = Collector-ring enclosure by means of felt washer and seal ring on diode plate
12 = Swivel arm as in old T 1

Bosch has developed a new T 1 alternator, which is intended to gradually supersede the present standard T 1 model with hinge mounting. The electrical design (stator core and claw-pole halves) has been adopted from the standard T 1 series produced up till now.

The new T1 is a 16-pole claw-pole alternator. The stator core is not pushed into a "stator frame" as in the previous model, but clamped between two end shields. This end shield design (with 1-piece diode assembly) has been employed for several years in G 1, K 1 and N 1 alternators and has to date proved fully successful.

The dimensions of the swivel and holding arm as well as the distance to the pulley are the same as with the standard T 1 model, so that generally speaking the T 1 alternator can be mounted on the engine without any change to the alternator fastening parts being necessary. The same or even greater power – the alternator itself being smaller and lighter – is achieved by using two additional diodes at the neutral point (as described in VDT-I-120/1 B) and optimum cool-air ventilation in conjunction with the fan (outer dia. 210 mm).

The alternator bearings can be greased as before. The grease cups should be refilled twice in every

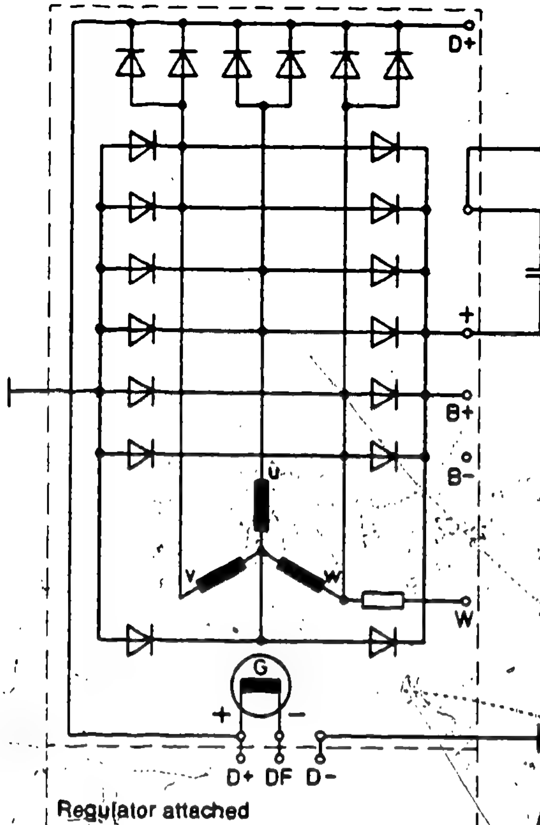


Fig. 2 Alternator wiring diagram with interference-suppression resistor

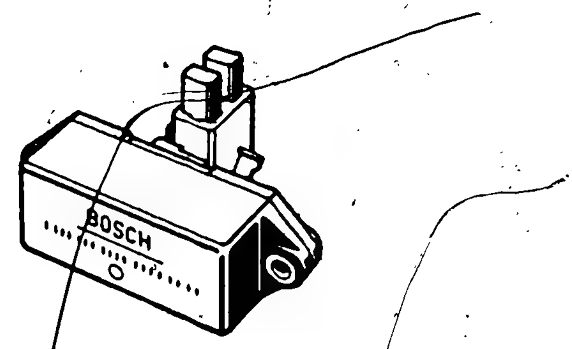


Fig. 3

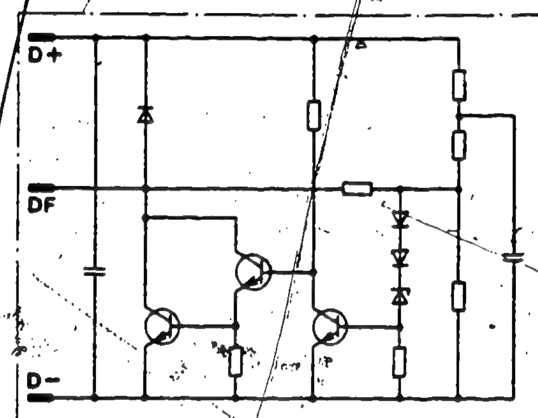


Fig. 4 Block diagram

100,000 km. The rectifiers or diode plate with heat sink are/is a spray-coated printed board as in the N 1 28 V alternators.

Terminals B+, B−, W and D+ are of the stud-type, being covered by an air-intake cover and protected against corrosion.

For over-voltage protection the devices used up till now in standard T 1 alternators can also be used for the new alternators. Thus six 1 A exciter diodes are fitted. The new T 1 alternator has the following characteristics:

- smaller and lighter construction
- same power though requires less space
- reasonably-priced since mass-produced
- easy maintenance
- dust-proteced by means of collector-ring enclosure
- terminal "W" interference-suppressed due to 3.3 kΩ resistor built into cable. In conjunction with the vehicle electrical system and a tachometer this results in a lower interference voltage.
- attached-type transistor regulator, therefore electrical system less susceptible to trouble.

Attached-type transistor regulator 0 192 053 001 – EE 28 V 3

The attached-type transistor regulator EE 14 V 3 used in G 1 and K 1 alternators is today mass-produced and has fully proved itself. We assume familiarity with the operation and mounting of this regulator.

Construction and dimensions of the EE 28 V 3 regulator are identical to those of the EE 14 V 3 (no external difference can be detected).
The regulator with brush holder is so designed that it cane be fitted in place of the brush holder for the separate regulator in G 1, K 1, N 1 and T 1 alternators.
Advantages of the EE 28 V 3 attached-type transistor regulator:

- alternator and regulator one compact unit
- regulator and brush holder one compact unit
- no fastening or electric cable costs as in the case of e.g. separate regulators
- can be fitted subsequently on alternators of the 1piece diode assembly type (instead of brush holder for separate regulator).

BOSCH

VDT-WJE 315/3 B **LJ**

Edition

REPAIR INSTRUCTIONS
INSTRUCTIONS DE REPARATION
INSTRUCCIONES DE REPARACION

T2 (RL) 28 V	62A10	**0 121 600 0..**
	85A12	**0 121 600 0..**
	125A30	**0 121 600 0..**

Contents

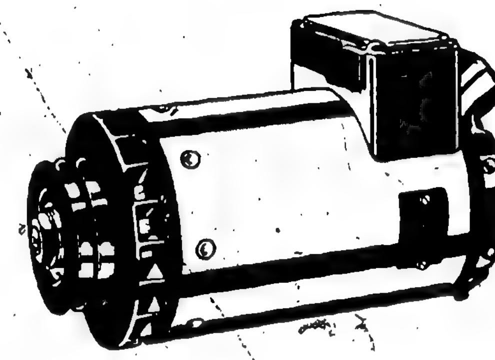


Fig. 1

Sommaire

Alternators
Alternateurs
Alternadores

Contenido

ROBERT BOSCH GMBH STUTTGART GERMANY

A 21

1. Required test equipment, tools, lubricants, etc.

			Bosch Part No.
Test equipment:	Test and transformer panel	EFAW 81 and ..82	0 681 169 013 and ..014
	Dial indicator	EFAW 7	1 687 233 011
	Magnetic stand	EW/MS 1B1	0 601 980 001
	Ohmmeter (e.g. Pontavi)		Commercially available
Tools:	Lathe tailstock steady		" "
	Ball bearing extractor		" "
	Mounting device for fan pulley		" "
	Arbor press		" "
	Torque spanner		" "
	Fitting tool EFLJ 64 for radial seals		1 683 203 011
Lubricants:	Grease for ball bearings and radial seals in can containing 1 lb		Bosch grease VS 9840 5 927 310 000
	Grease for ball bearing seats		Bosch grease Ft70v1
	Silicon paste for diode contact surfaces		Bosch grease Ft 2v2
	Corrosion protection paint VS 9994-Fl		5 928 850 000
Documents:	Spare parts list		VDT-EVE 315/5
	Test instructions for alternators		VDT-WPE 315/1B and ../2B
	Test specifications for alternators		VDT-WPE 315/10-1B

1. Appareils de contrôles indispensables, outillage, lubrifiants, etc.

			Référence Bosch
Appareils de contrôle:	Tableau de contrôle et de transformation	EFAW 81 et ..82	0 681 169 013 et ..014
	Comparateur	EFAW 7	1 687 233 011
	Support à pied magnétique pour instrument de mesure	EW/MS 1B1	0 601 980 001
	Ohmmètre (Pontavi par ex.)		commerce courant
Outillage:	Lunette de poupée mobile pour tour		" "
	Dispositif d'extraction pour roulements à billes		" "
	Dispositif de maintien pour poulie de ventilateur		" "
	Presse à poinçon		" "
	Clef dynamonétrique		" "
	Outil à presser EFLJ 64 pour joints radiaux		1 683 203 011
Lubrifiants:	Graisse pour roulements à billes et joints radiaux en boîte de 453 g		Graisse Bosch VS 9840 5 927 310 000
	Graisse pour sièges de roulements à billes		Graisse Bosch Ft70v1
	Pâte aux silicones pour sièges de diodes		Graisse Bosch Ft 2v2
	Peinture anticorrosive VS 9994-Fl		5 928 850 000
Documentation:	Liste des pièces de rechange		VDT-EVE 315/5
	Instructions d'essai pour alternateurs		VDT-WPE 315/1F et ../2F
	Valeurs d'essai pour alternateurs		VDT-WPE 315/10-1D/F

1. Aparatos de ensayo que se precisan: herramientas, lubrificantes etc.

			Número de pedido Bosch
Aparatos de ensayo:	Cuadro de pruebas y de transformador	EFAW 81 y ..82	0 681 169 013 y ..014
	Micrómetro de esfera	EFAW 7	1 687 233 011
	Soporte de medición de pie magnético	EW/MS 181	0 601 980 001
	Ohmiómetro (p.ej.Pontavi)		usual en el comercio
Herramientas:	Luneta de contrapunto		" " "
	Dispositivo extractor de rodamientos de bolas		" " "
	Dispositivo de sujeción de la polea-ventilador		" " "
	Prensa de mandril		" " "
	Llave dinamométrica		" " "
	Herramienta de embutición EFLJ 64 para juntas radiales		1 683 203 011
Lubrificantes:	Grasa lubrificante para rodamientos de bolas y juntas radiales		Grasa Bosch VS 9840
		en botes de 453 g	5 927 310 000
	Grasa lubrificante para asientos de rodamientos de bolas		Grasa Bosch Ft70v1
	Pasta de siliconas para superficies de apoyo de los diodes		Grasa Bosch Ft 2v2
	Pintura anticorrosión VS 9994-Fl		5 928 850 000
Documentación:	Lista de piezas de recambio		VDT-EVE 315/5
	Instrucciones de ensayo para alternadores		VDT-WPE 315/1 SP y ../2 SP
	Valores de ensayo para alternadores		VDT-WPE 315/10-1 SP

2. Circuit diagram

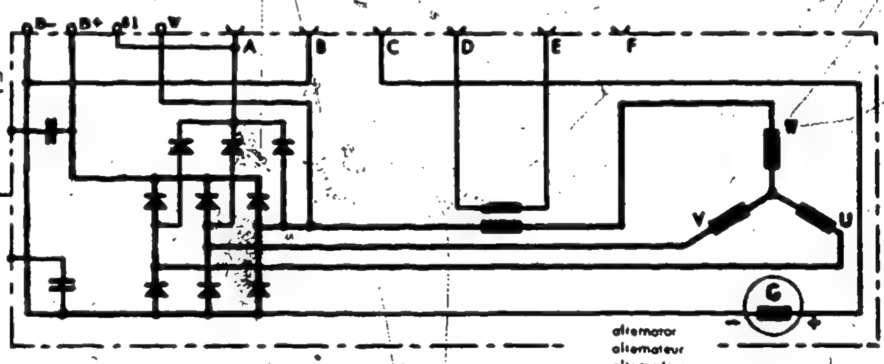


Fig. 2
Circuit diagram for T2(RL)28V125A30

Note:

On ... 62A10, the condenser between negative diodes and earth is eliminated.
On ... 85A12, the transformer is eliminated.

2. Schéma

Figure 2 Schéma de T2 (RL) 28V 125A 30

Remarque:

Sur ... 62A 10 le condensateur entre les diodes négatives et la masse n'existe pas.
Sur ... 85A 12 le transformateur d'intensité n'existe pas.

2. Esquema de conexiones

Fig. 2 Esquema de conexiones para T2 (RL) 28V 125A 30

Observación:

Para ... 62A 10 se suprime el condensador entre los diodos negativos y masa
Para ... 85A 12 se suprime el transformador de intensidad

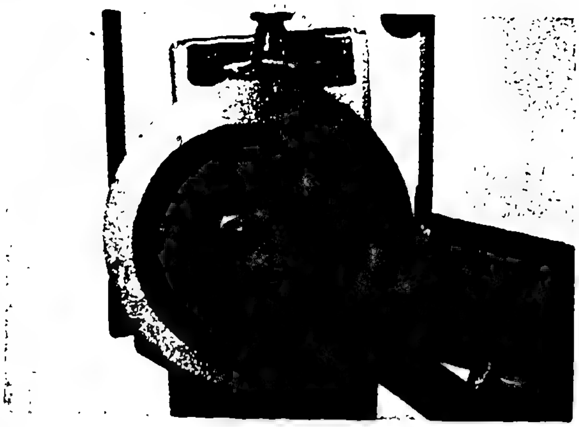


Fig. 3

3. Dismantling the alternator

Secure alternator in clamping block EFAW 9.

Hold belt pulley in suitable holding device and undo nut.

Remove belt pulley and fan.

Mark position of drive and slip-ring end bearing.

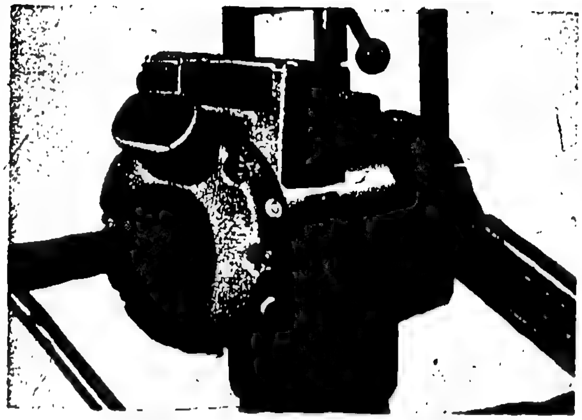


Fig. 4

On alternators with shaft stubs at both ends, release coupling claw prior to remove belt pulley (Fig. 3).

Remove cover over the carbon brushes.

Withdraw carbon brushes and secure in withdrawn position.

Unscrew the cover with the air inlet tube.


Fig. 5

Undo the 4 inner and 8 outer fixing screws

Remove drive bearing assembly.

Carefully withdraw rotor.

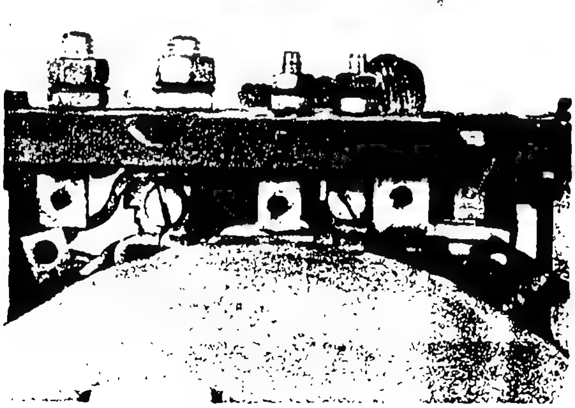


Fig. 6

Remove cover. Release 6-pin plug (Bendix).

Unscrew the 4 fixing screws of the connection housing and remove.

Disconnect connection cable as shown in Fig. 6

Mark connection cable to facilitate re-assembly.

WJE 34513
Seite 5

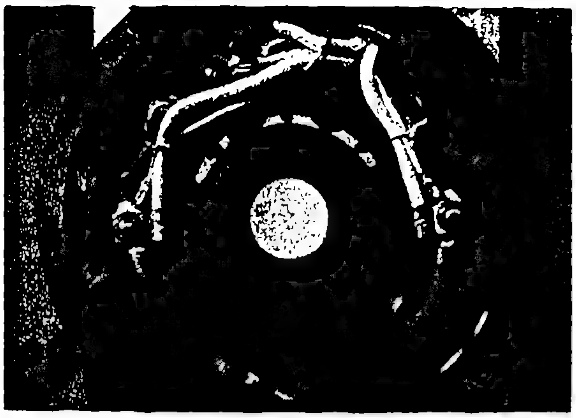


Fig. 7

Disconnect diode and stator cables from connection plate.

Unscrew connection plate

Fig. 8

On alternator Type ...125A30 it is essential to hold the bolt from behind with an open-ended spanner whilst unscrewing the diode connections, to prevent damage to the diodes.

Fig. 9

Turn stator housing in clamping block through 180° and release the connection bus bar/heat sink with screwdriver.

Remove slip-ring bearings.

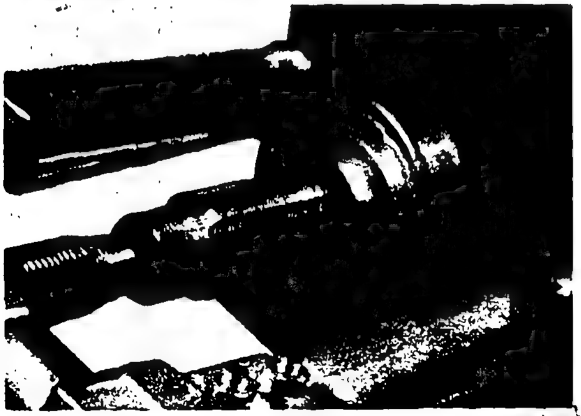


Fig. 10

Secure rotor in clamping block. If it is necessary to remove the ball bearing on inner ring or thrust bearing, make certain that extractor claws are applied as close as possible to the shaft.
It is essential to renew ball bearings after approximately (120,000 km) 75,000 miles or if they have been removed from the rotor.

4. Clean components briefly in benzine or thrichlorethylene.

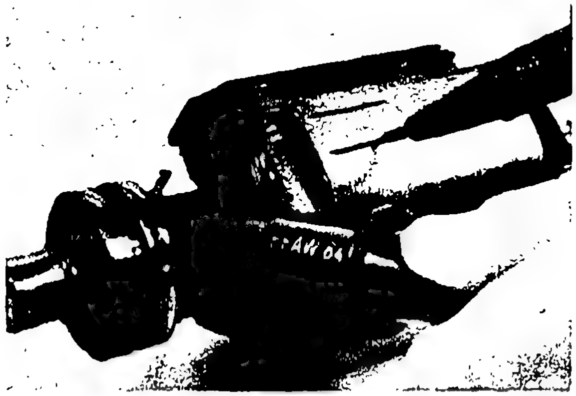


Fig. 11

5. Inspection and repair of individual components

Check single-pole rotor for short circuit to earth. Test voltage 80 V A.C. Check exciter winding with Ohmmeter. Resistance value 3.65 Ohm +10 %.
Should the slip rings require skimming, observe that minimum permissable diameter is (57 mm) 2.24 in. and maximum run-out (0,03 mm) 0.0012 in. The slip ring surface must be absolutely smooth (only diamond or tungsten carbide turning tools should be used).

Fig. 12

Thrust bearing

After removing the old shaft seal, fit new seal using tool EFLJ 64.

Subsequently grease seal lip amply with VS 9840.

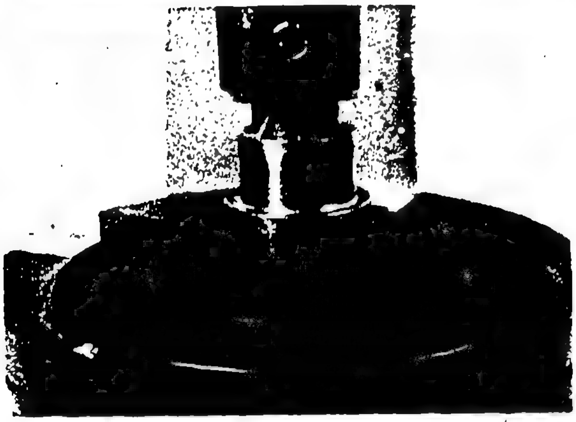


Fig. 13

Drive bearing

After fitting a new shaft seal, using tool EFLJ 64, amply grease seal lip with VS 9840.
Attention!

It is essential to renew the shaft seals of both thrust and drive bearings!

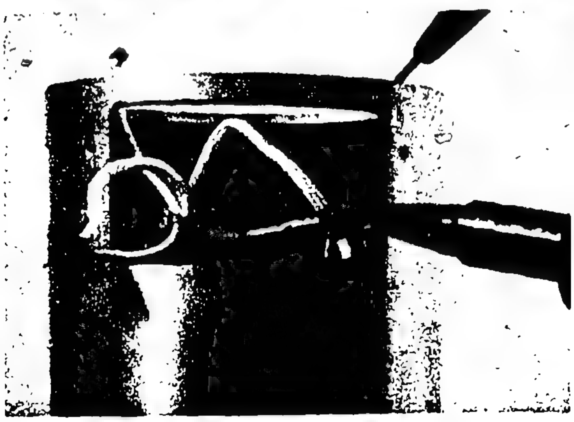


Fig. 14

Yoke with stator

Check for short circuit to earth.
Test voltage 80 V A.C.

Fig. 15

Check resistance of stator winding between all phases (winding ends).

Resistance data:

... 62A10 = 0.058 Ohm + 10 %
... 85A12 = 0.058 Ohm + 10 %
...125A30 = 0.0146 Ohm + 10 %

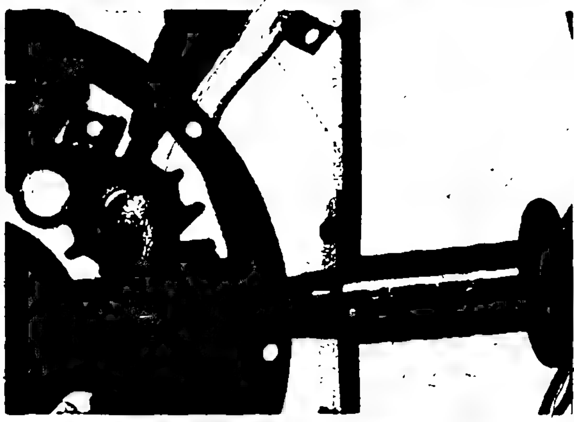


Fig. 16

Slip ring bearings, output diodes

Check diodes for continuity and cut-out direction with test lamp.
Test voltage 6 V D.C.

The 3 diodes on each heat sink must have the same polarity.

Fig. 17

Unscrew defective diodes with socket wrench.

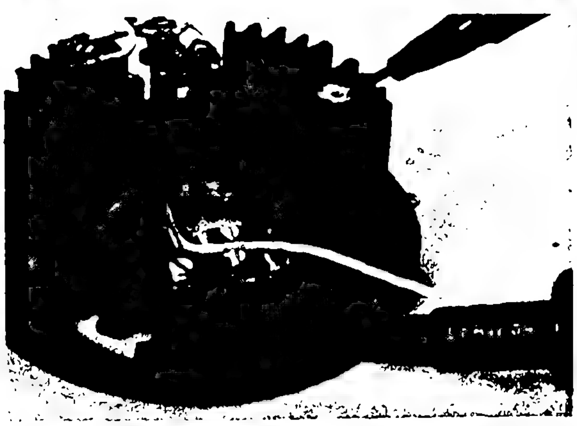


Fig. 18

Check heat sink for short circuit to earth. Test voltage 80 V A.C.

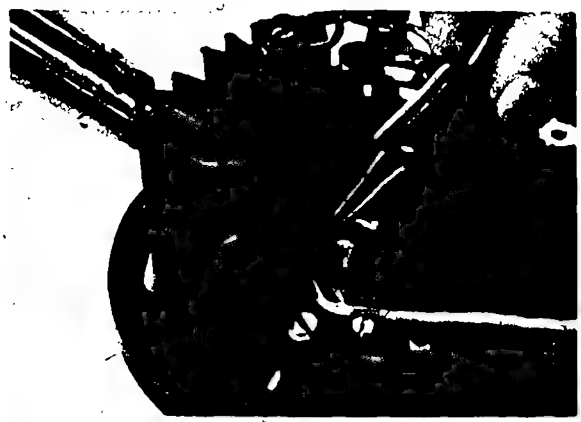


Fig.19

Renew carbon brushes.
Ensure that no solder flows into the braided cable when soldering.
Use only resin tin solder!
After soldering, check carbon brushes in brush holders for ease of movement.

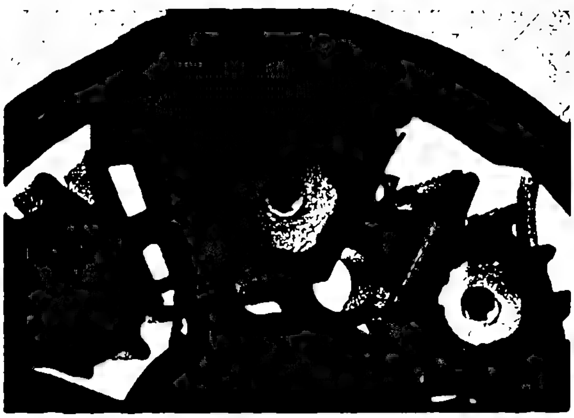


Fig.20

Prior to screwing new diodes into position, coat their contact surface with silicon paste Ft 2v2.

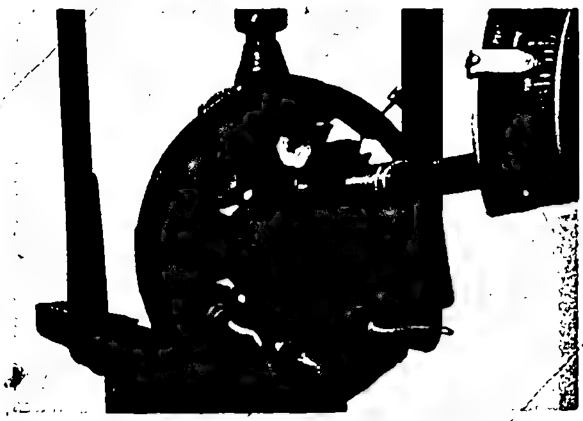


Fig.21

Screw in diodes and tighten with torque spanner. Tightening torque for output diodes (23..28 cmkg) 1,7..2,0 ft.lb.

Corrosion protection!

Finally, all bare metal surfaces of the heat sink must be coated with black paint VS 9994-Fl.

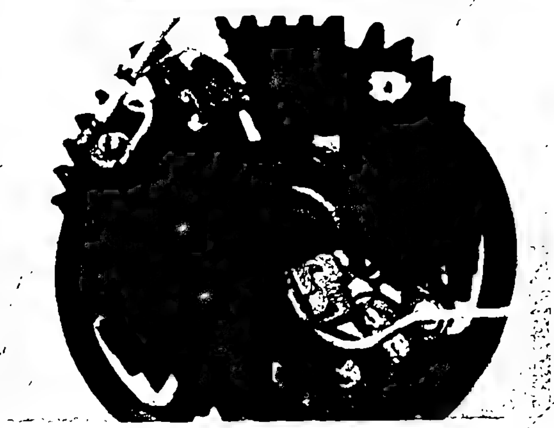


Fig.22

Grease ball bearing seat with Ft 70v1!
(If the ball bearing seat is damaged, the complete slip ring bearing must be renewed).

Coat fixing screws and all bright parts on heat sink with paint VS 9994-Fl.

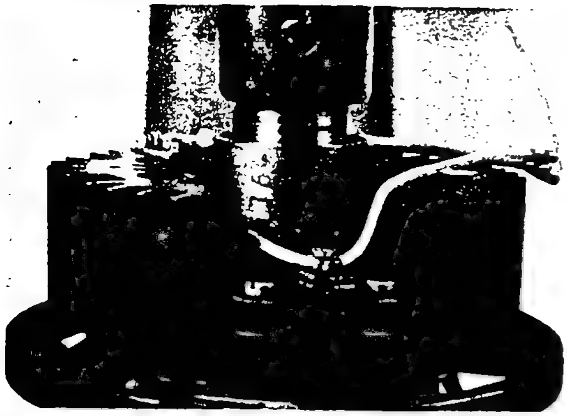


Fig.23

Alternators with shaft stubs at both ends incorporate a shaft seal in the slip ring bearing.
Press new shaft seal into position using tool EFLJ 64, during this work the slip ring bearing must be placed on a suitable support in the arbor press.

Fig.24

Connection bus bar

Check condenser with test probes EFAW 84.

In the event of a defective condenser, the complete assembly (holding block with condenser) must be renewed.

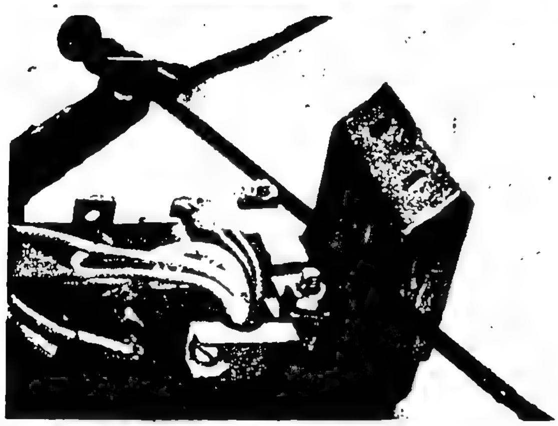


Fig.25

Check secondary winding of transformer:
1. on winding ends (Fig.25) and
2. on Bendix connector between D and E.

The resistance values:

...28 V 62A10 = approx. 10 Ohm.
...28 V 125A30 = approx. 110 Ohm.

Deviating values (between 1 and 2) denote badly soldered connection.

Fig.26

Renew defective exciter diodes.
Bend back holding clips for exciter diode cable.
Prior to fitting, coat contact surfaces of diodes with grease Ft 2v2.

W3E 31513
Seite 10

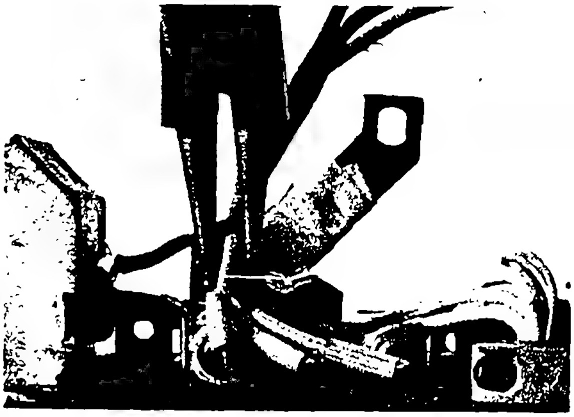


Fig. 27

Slide insulating tube over cables.

Close holding clip and coat bright surfaces with paint VS 9994-FI.

Ensure clearance between load-carrying components and earth.

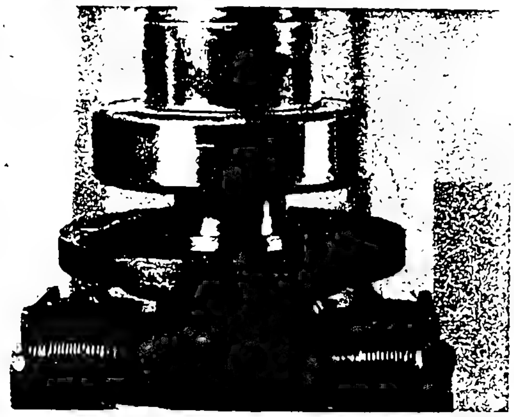


Fig. 28

Single-pole rotor

Place rotor together with suitable support into arbor press.
Slide bush on shaft then carefully placing thrust bearing into position.
Press on ball bearing.
Note! New ball bearings are greased.

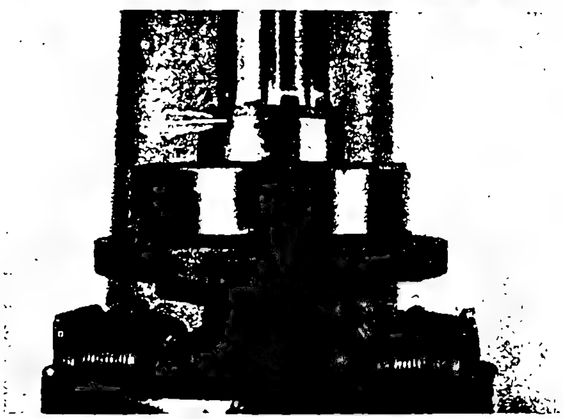


Fig. 29

Place intermediate ring on rotor shaft drive side so that the chamfer on the ring faces upward.

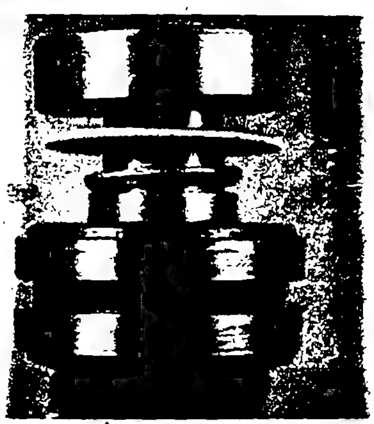


Fig. 30

Slip ring side of rotor shaft:
First place intermediate ring (chamfer downward) in position and then the "Nilos" ring.

Press on ball bearing.

On alternators with shaft stubs at both ends an additional intermediate ring is placed on top of the ball bearing (see Fig. 29).

82

B2

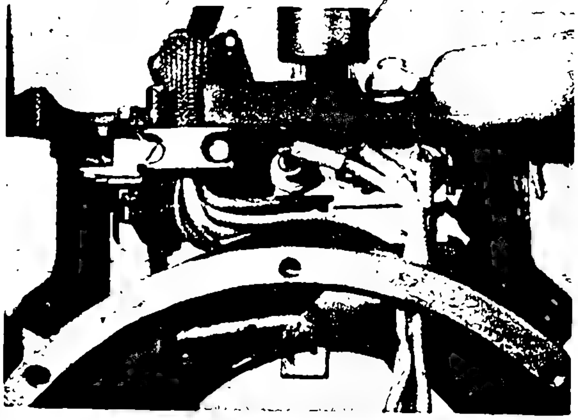


Fig.31

6. Assembly

To increase corrosion resistance of alternators, all bright surfaces (screw heads, heat sink, etc) should be coated with black paint VS 9994-Fl during assembly.

Secure stator housing in clamping block EFAW 9. Place connection bus bar in position and screw down lightly.

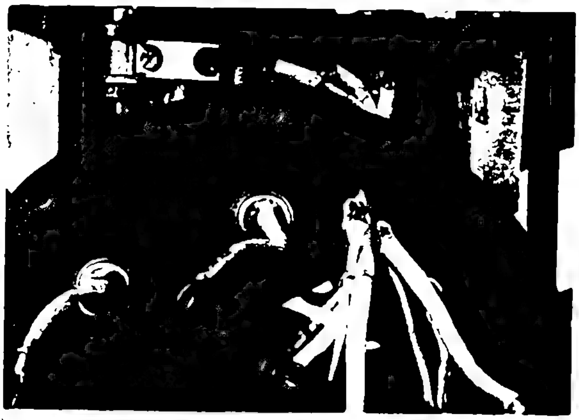


Fig.32

Fit slip ring bearing. When threading the cables through their hole, the glued-in insulating paper in the heat sink must not be damaged.
Screw connection housing bus bar to heat sink (see Fig.9). Tighten fixing screws on connection housing.
Bind connection cables together with hemp string close to heat sink.

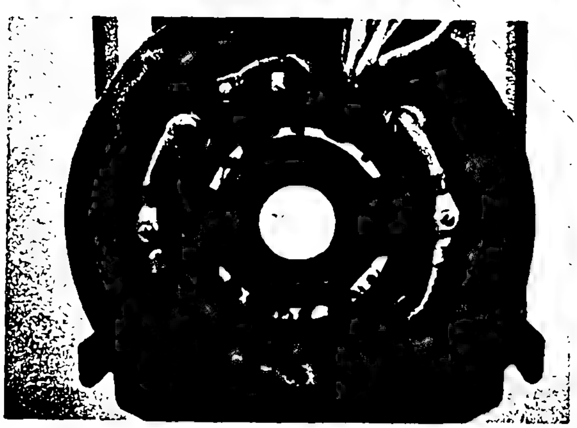


Fig.33

Secure connection plate with 4 cheese-headed screws.
Connect diode connection cable as shown in Fig.33.

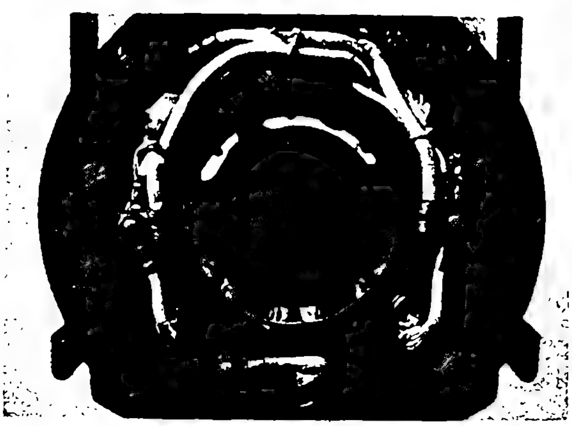


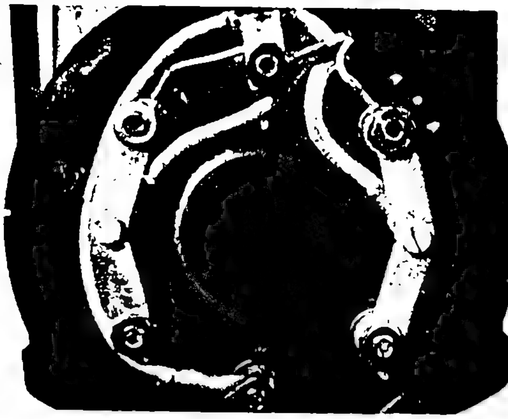
Fig.34

Connect cables in accordance with circuit diagram (Fig.2) and bind with hemp string.

Screw cover into position.

B3

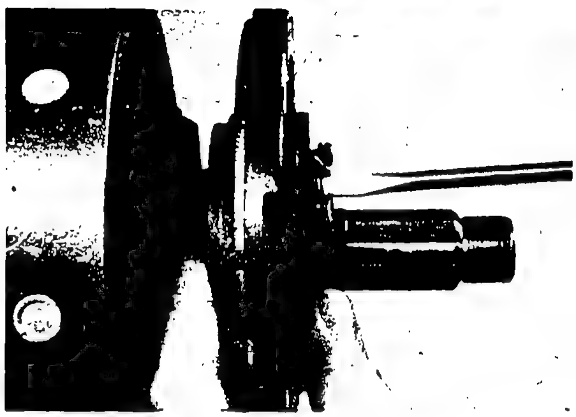
33



Cable pisitions and their fixing in alternator ...125A30:

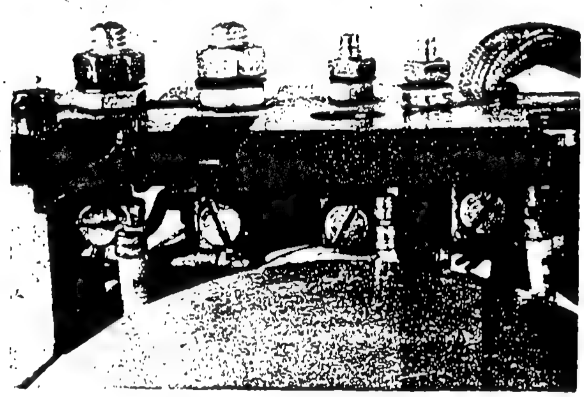
Note: Secure lock nut!
Cables should be bent through the largest possible radius.

Fig.35



Withdraw carbon brushes:
Carefully slide rotor into stator housing to approx. 2/3 of its length.
Assemble drive and thrust bearings with the screws.
Now slide in rotor fully and tighten down drive bearing.
Apply compression springs to carbon brushes and screw covers into position.

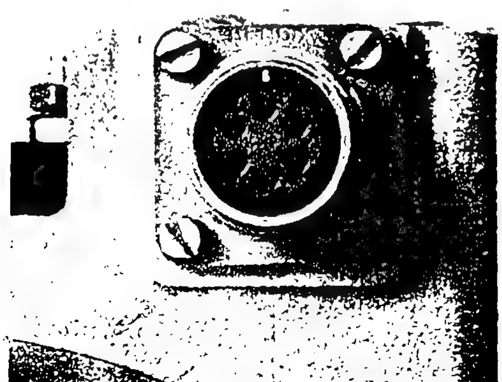
Fig.36



There must be sufficient clearance between stator housing and connection cables (danger of short circuit to earth)

Tighten all screws and coat screw heads with black paint VS 9994-Fl.

Fig.37



Place connection housing in position and screw down.
Screw Bendix socket (with pin and letter marking at top) into position.
Fit rubber grommets and cover.
Place fan and belt pulley in position tightening fixing nut to (12...15 mkp) 87...108 ft.lb.

Fig.38

WJE 31513
Seite 13

7. Technical data

Slip ring eccentricity		max. 0.03 mm (0.001")	
Minimum length of carbon brushes		12 mm (0.47")	
Brush pressure		450 .. 550 p	(16..19,5 oz)
Minimum slip ring diameter		57 mm (2.24")	
Resistance of stator winding			
on T2 (RL) 28 V	62 A 10	0.058 Ohm + 10 %	
...	85 A 12	0.058 Ohm + 10 %	
...	125 A 30	0.0146 Ohm + 10 %	
Resistance of exciter winding (rotor)		3.65 Ohm + 10 %	
Tightening torque of fan belt pulley nut		12 ... 15 mkg	(87 ... 108 ft.lb)
of exciter diodes		13.5 .. 17 cmkg	(1,0...1,3 ft.lb)
of output diodes		23 ... 28 cmkg	(1,7...2,0 ft.lb)

8. Testing the alternators

See testing instructions	VDT-WPE 315/1 B	LJ
	VDT-WPE 315/2 B	LJ
Test specifications, see	VDT-WPE 315/10-1 B	LJ

7. Caractéristiques techniques

Faux-rond des bagues collectrices		0,03 mm max.
Longueur minimale des balais		12 mm
Pression d'appui des balais		450 à 550 g
Diamètre minimal des bagues		57 mm
Résistance de l'enroulement du stator		
sur T2 (RL) 28 V	62 A 10	0,058 ohm + 10 %
...	85 A 12	0,058 ohm + 10 %
..	125 A 30	0,0146 ohm + 10 %

B5

BOSCH

REPAIR INSTRUCTIONS

VDT- WJE 315/3 B LJ

Edition 7.68 1st Supplement

Translation of German edition of 5.68

ALTERNATORS 0 120 600 0..

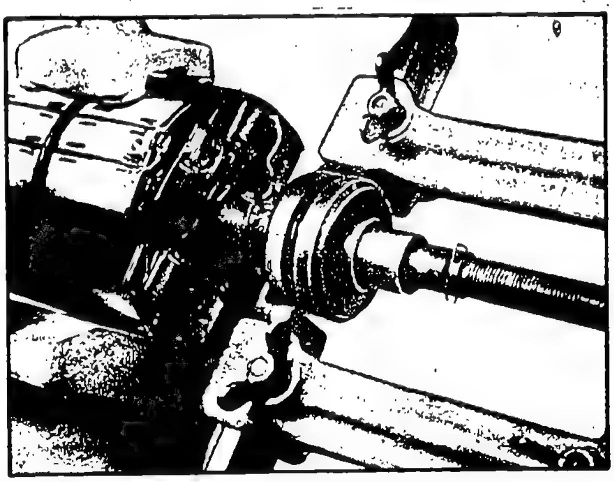
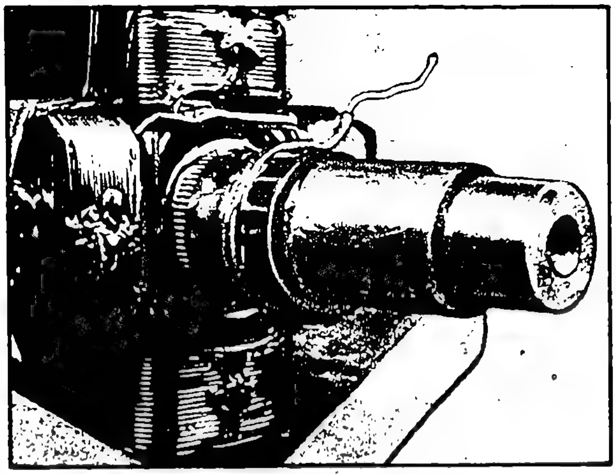


Fig. 1

1. Replacing the slip rings.
   Mount rotor in clamping device. Unsolder the winding leads from the slip rings carefully with a soldering gun or soldering iron. Pull off slip rings with a claw puller.

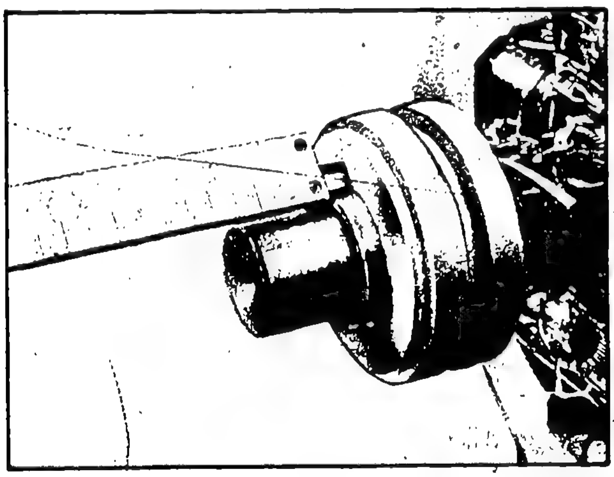
   Fig. 1



Clean rotor shaft and roughen the surface where the slip ring sits so that it cannot displace during cementing and hardening of the cement.
Coat shaft at the slip ring seat and the inside of the slip ring with Resinol (Kk 65 v 1).

Fig. 2

Fig. 2



When pushing on the slip ring, a distance of 6.2 mm (0.244 in.) from the collar on the rotor shaft to the slip ring must be observed, also observe the position of the connections.
Solder winding leads to slip ring connections and then coat with Resinol.
Place rotor in heating oven and harden for one hour at 160°C (320°F).
Machine slip ring according to sec. 5 of VDT-WJE 315/3 B.

Fig. 3

Fig. 3

1.1 Testing the rotor
The rotor test is carried out according to sec. 5 of VDT-WJE 315/3 B.

New Product

VDT-I-120/3 En

5.1983
Replaces Ed. 1.1983

PERMEABLE-ROTOR ALTERNATOR
(without collector rings)

0 122 469 0.., N3 - 28 V

with attached-type transistor voltage regulator
0 192 053 010, EE 28 V 3

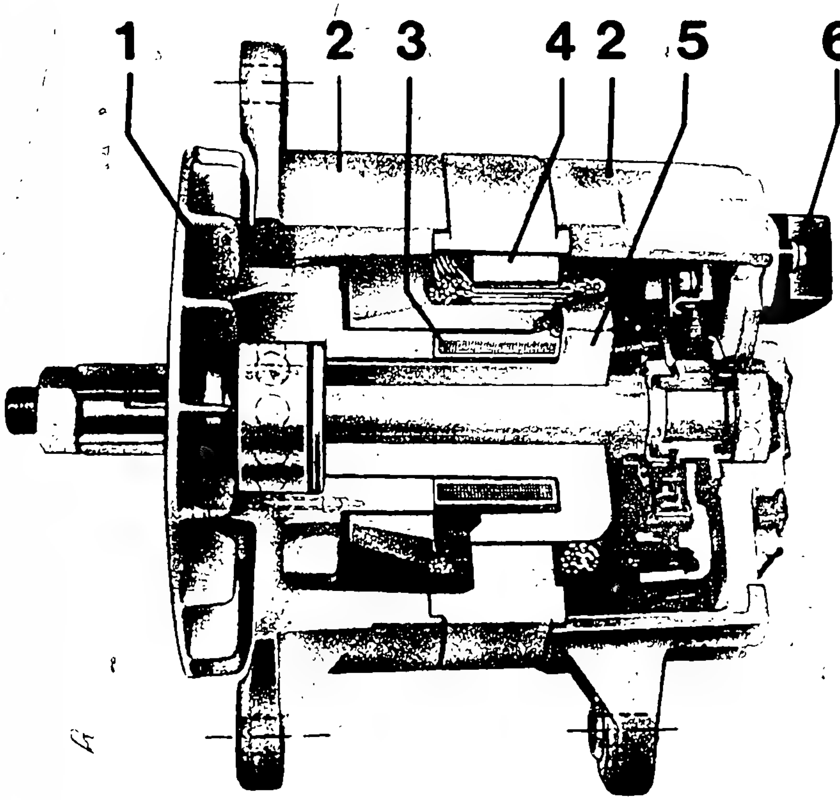


Fig. 1

1 Alternator, section drawing

1 = Fan
2 = End shields
3 = Pole body with winding
4 = Stator
5 = Rotor without winding (permeable rotor)
6 = Attached-type transistor voltage regulator
EE 28 V 3

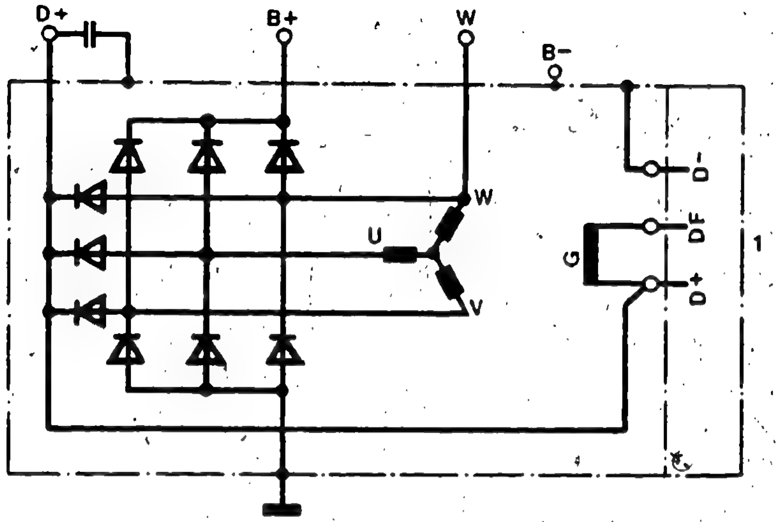
2 Construction

12-pole through-ventilated synchronous generator with integrated rectifier using silicon diodes in a three-phase bridge circuit.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

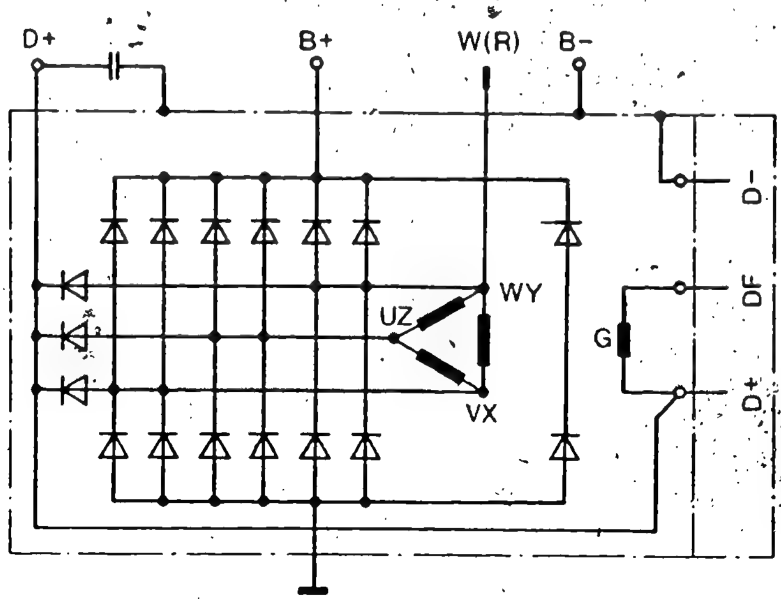
Designed without collector rings, permeable rotor (rotor without winding), no rotating windings. Hard-wearing, robust construction for extended service life under extreme conditions.

③ Alternator circuit diagram



Alternator N3 - 28 V 35 A 19

1 = Attached-type transistor voltage regulator



Alternator N3 - 28 V 50 A 20

1 = Attached-type transistor voltage regulator

The terminals B+, B-, W and D+ are in the form of screw connections on the outside of the alternator. The voltage regulator is protected against mechanical damage by a cover screwed onto the end of the alternator.

The following features characterize the N 3 alternator:

Low maintenance level required (relubrication is unnecessary, there are no carbon brushes fitted and no collector rings)

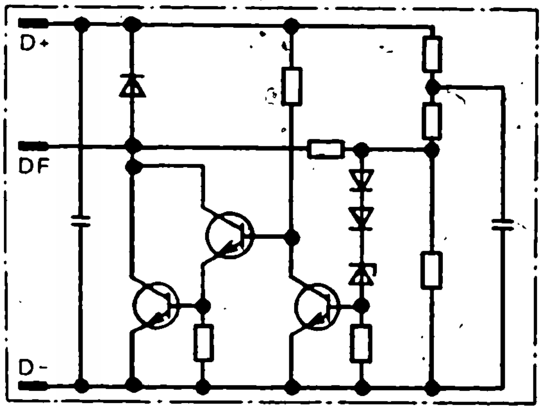
Long service life

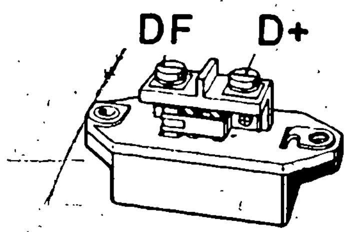
Pre-excitation is not necessary

The attached-type transistor regulator is proof against the voltage peaks which can occur in the vehicle voltage system.

The alternator can be operated without battery.

④ Attached-type transistor voltage regulator 0 192 053 010 - EE 28 V 3





Basic circuit

The construction and dimensions of the voltage regulator 0 192 053 010 are almost identical to those of the EE voltage regulator 28 V 3. Instead of carbon brushes, two screw connections are fitted for D+ and DF.

BOSCH

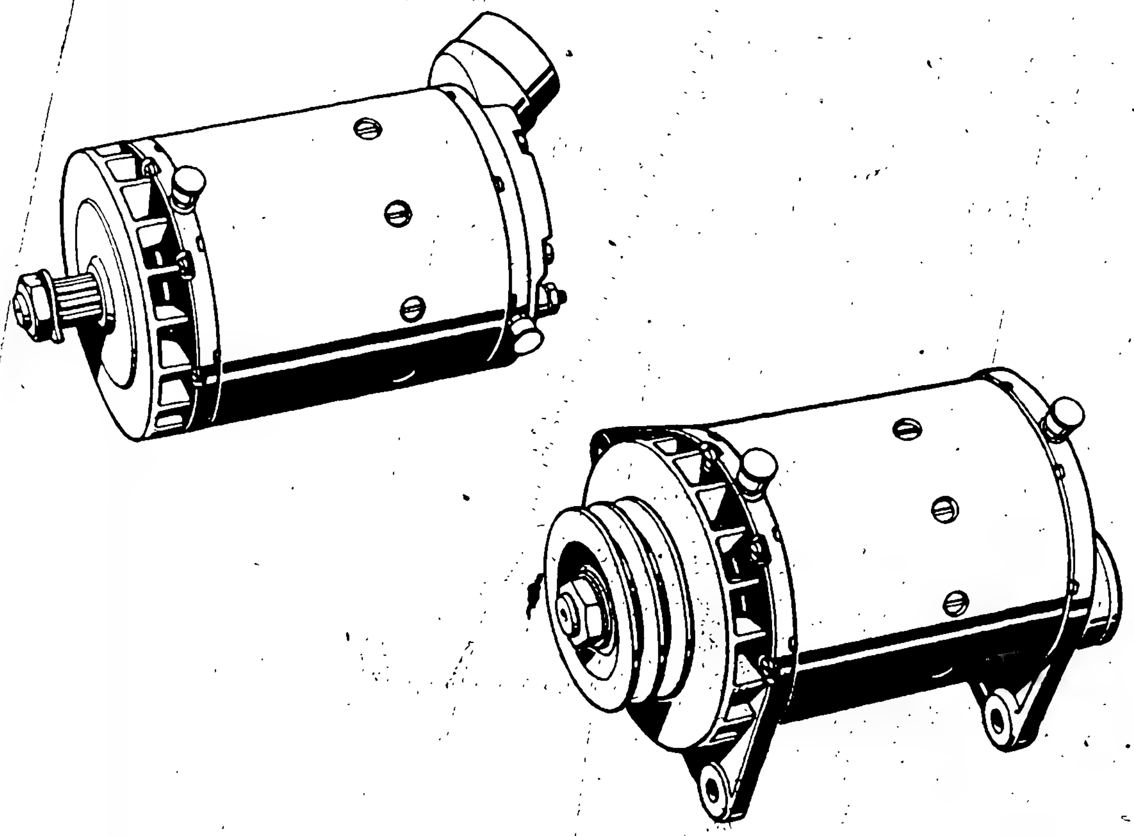
VDT – WJE 315/4 B 6.70

LJ

Edition 6.70

Translation of German edition of)
Traduction de l'édition allemande du) 10.69
Traducción de la edición alemana del)

REPAIR INSTRUCTIONS
INSTRUCTIONS DE RÉPARATION
INSTRUCCIONES DE REPARACION



Alternators
Slipring-less Alternator with built-in exciter-generator

Alternateurs
Alternateurs sans bague collectrice, avec excitatrice incorporée

Alternadores
Alternador sin anillos rozantes, con excitatriz incorporada

(T4 (RL) 28V 60A 12) **0 123 689 5 . .**

Contents

1. Test equipment, tools, lubricants and technical documentation required

Test equipment

Alternator tester	EFAW 192	0 681 101 403
Test panel	EFAW 81	0 681 169 013
Transformer panel	EFAW 82	0 681 169 014
Ohmmeter (e.g. Pontavi)		commercially available

Tools

Clamping support	EFAW 9	0 681 269 007
Assembly device	EFLJ 57 A	1 688 110 048
Ballrace puller bell set	EF 3235	0 681 369 012
Extracting jaws set	EF 3116	0 681 369 013
Mandrel	EFLJ 64	1 683 203 011
Arbor press		commercially available
Clamp for fan-belt pulley		commercially available
Extractor for ball bearing		commercially available
Soldering iron		commercially available

Lubricants

Roller bearing grease (50 gr tube)	Ft 1 v 34	5 700 009 005
Molycote-Paste (1 kg tin)	Ft 70 v 1	5 700 040 210
Silicon oil (0.1 l can)	Ol 63 v 2	5 701 112 511
Corrosion protection paint (1 kg tin)	Vs 9994 Fl	5 928 850 000
Insulation lacquer (100 gr tin)	Fl 57 v 13	5 721 020 001

Further technical documentation

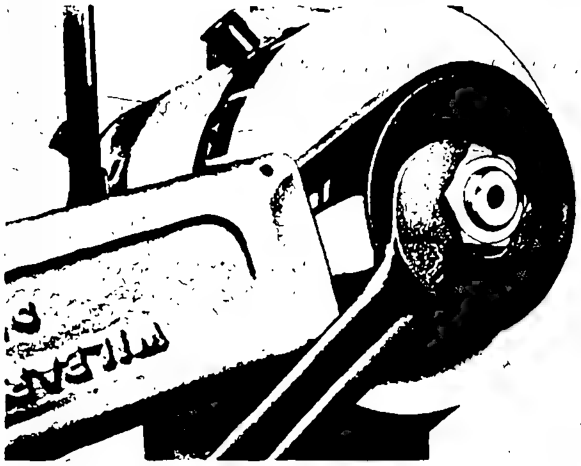
Service parts list	VDT-EVE 315/9
Test instructions	VDT-WPE 315/1, ../2 B
Test specification sheet	VDT-WPE 315/10–1 B
Test instructions for transistorized regulator	VDT-WPE 320/2–13 B
Conversion instructions for test bench	VDT-WUF 113/4 B
Operating instructions for EFAW 192 (previously VDT-WWF 113/6)	VDT-UBF 113/6 B

WJE 31514
Seite 3

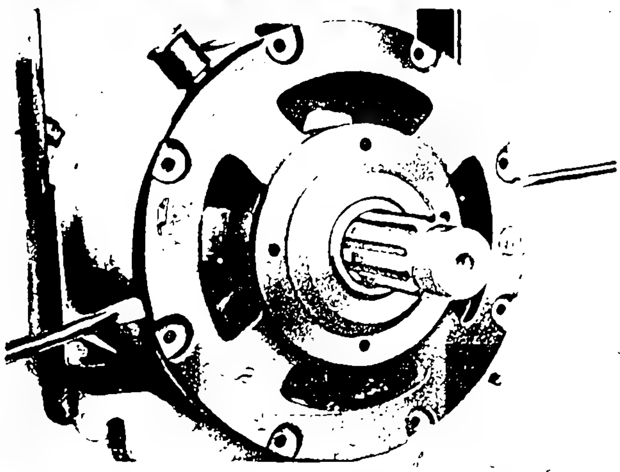
2. Dismantling the alternator

Mount alternator in clamping support EFAW 9. Mark relative position of field frame to drive end frame or rectifier bearing frame.

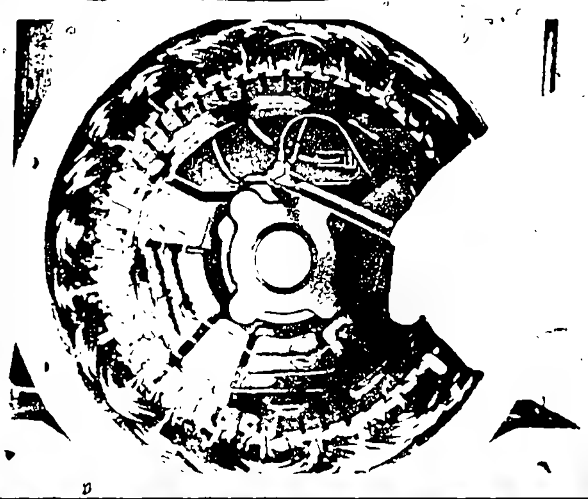
1 On alternators with shaft stubs at both ends remove half-coupling from taper, if necessary using extractor. Secure belt pulley with suitable clamp (e.g. Wilbar 6601) or hold with open end wrench across flats of coupling. Withdraw key. Fig. 1



2 Secure belt pulley with clamp and undo nut with 36 mm ($1\frac{7}{16}$ in) open end wrench. Remove belt pulley and fan. Fig. 2

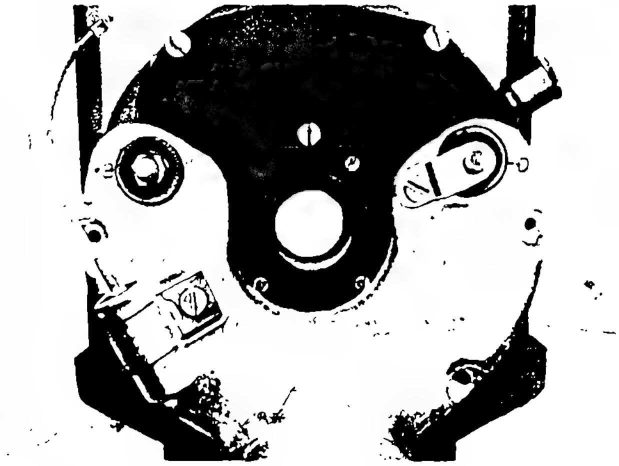


3 Undo fixing screws (8 outer, 4 inner) and lever off drive end frame. Carefully withdraw rotor. Fig. 3



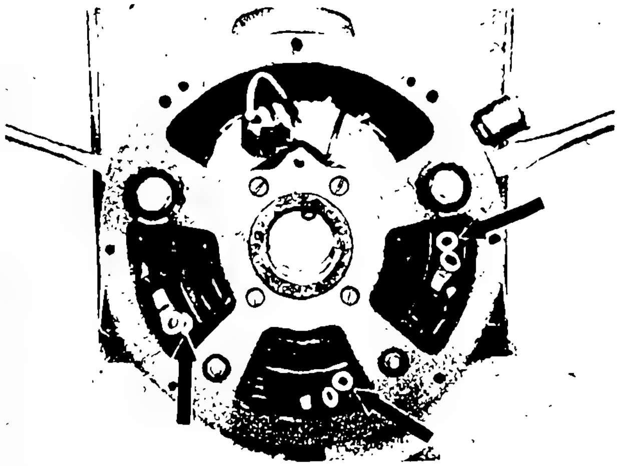
4 Loosen screw on rectifier bearing frame from inside (terminal D+). Fig 4

WJE 31514
Seite 4



5

Disconnect condensor from terminal B+ and earthing strap from terminal D–. Unscrew and remove duct cover. Fig. 5



6

Disconnect stator connection from heat sinks (see arrows). Unscrew regulator and pull off spade connectors. Undo remaining screws in flange and lever it off field frame. Fig. 6

3. Cleaning the components

Wash individual alternator parts briefly with petrol or trichlorethylene. Thoroughly clean out old grease from grease cups and grease channels.

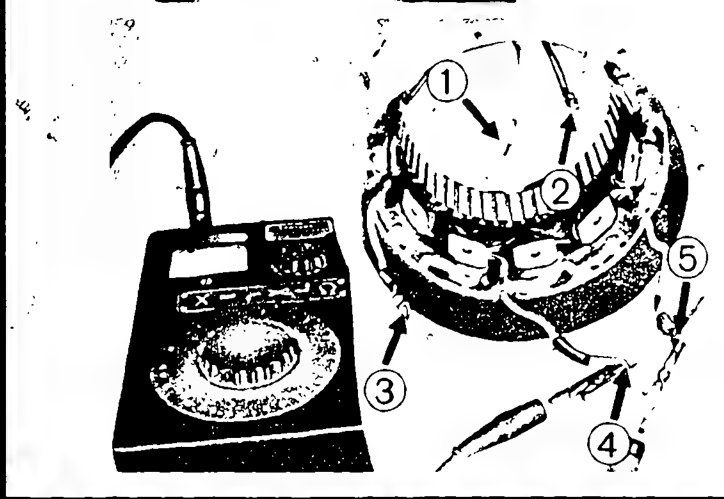
4. Checking and Repair

4.1 Field frame (Stator)

7

Check windings for ground short-circuit. Fig. 7
Test voltage: 80 V AC.

Measure winding resistance with ohmmeter (e.g. Pontavi).
Measure 3-phase winding of alternator between the three phase leads (see arrows 3, 4 and 5).
The field windings of the exciter generator consist of 10 individual coils connected in series with 2 fly leads (see arrows 1 and 2).



8

Resistance values:	
3-phase windings	0.16 Ω + 10 %
field windings	8.0 Ω + 10 %
	(0.8 Ω per coil)

Resistance measurements may also be carried out with EFAW 192 according to para. 4 and 5 of operating instructions VDT-UBF 113/6 B. Fig. 8

WDE 31514

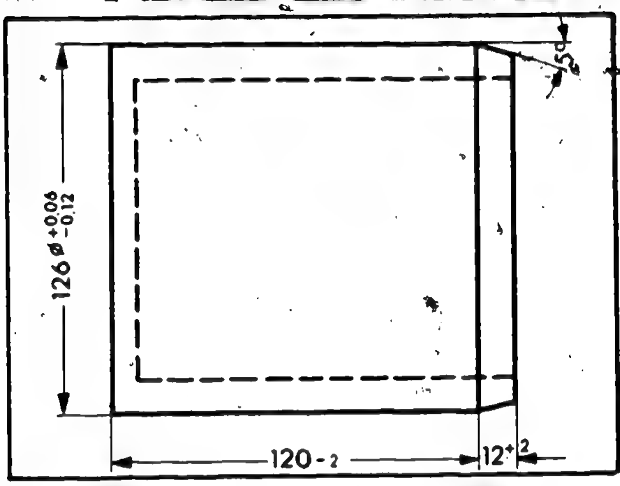
Sch 8

Replacing the field winding:

9

Place field frame in clamping support. Mark position of pole shoes and connecting leads. Insert pole-shoe screwdriver with suitable blade (part number 1 687 952 009), screwdriver blade to be ground to 9 mm ($\frac{3}{8}$ in) width at a shaft height of 11 mm ($\frac{7}{16}$ in) so that it fits into the recess holes of the countersunk screws.
Undo pole shoe screws. Thoroughly clean field frame and pole shoes. Fig. 9

Position new coil, insert pole shoes (watch markings) and tighten pole shoe screws. Correct position manually to avoid skew fitting.
Press in mandrel.



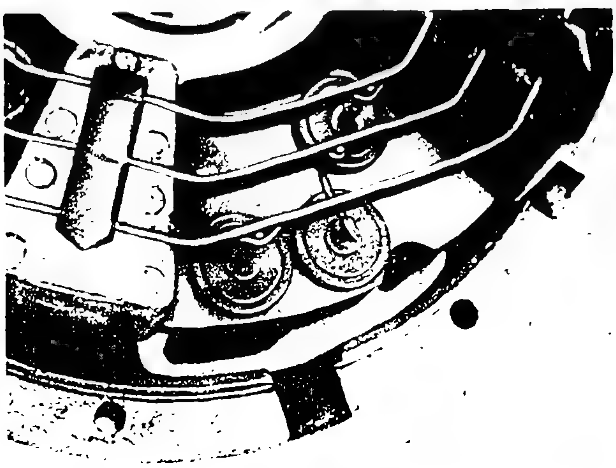
10

Mandrel:
Material Euronorm Fe 37 (Fe 42) B 3 FN Fig. 10
with bore to reduce weight,
wall thickness 12–15 mm ($\frac{1}{2}$ – $\frac{9}{16}$ in)
mark diameter on front face

11

Place field frame in clamping support and tighten pole shoe screws firmly with pole-shoe screwdriver.
Press out mandrel.
Check fitted coils for open- and ground short-circuit.
With "Uhu Plus" glue coil connection leads securely to field frame. Also glue the three leads of the 3-phase stator windings to the field frame. Fig. 11

Paint coils and inner yoke surface with lacquer Fl 57 v 13. Dry field frame in oven at 125° C (260° F) for 2 hours.
Clean pole shoes.



12

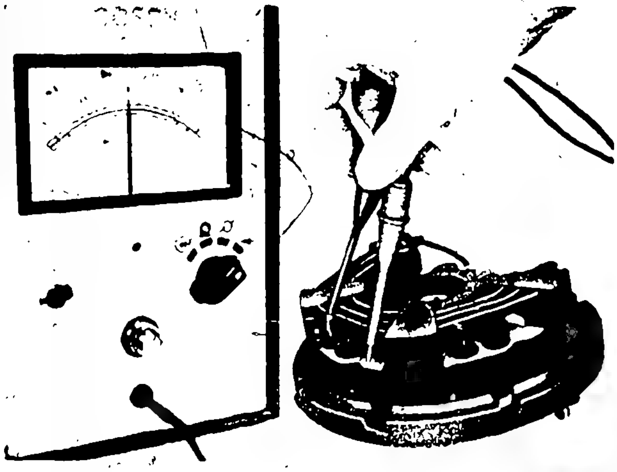
4.2 Rectifier bearing flange. Fig. 12

Forward direction:

Diode 1 (neg. diode) = from connection D– (outer current rail) to heat sink

Diode 2 (exciter diode) = from heat sink to connection D+/61 (middle current rail)

Diode 3 (pos. diode) = from heat sink to connection B+ (inner current rail)



13

Individually test press fit diodes with alternator tester EFAW 192. Fig. 13
See para. 3 of operating instructions VDT-UBF 113/6 B.
Clean off test points on heat sinks and current rails.

Test:

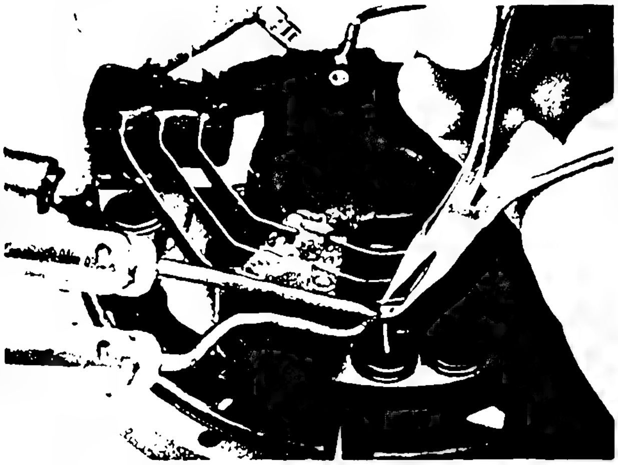
(with tester EFAW 192)

Diode 1 (neg. diode)
Test probes: to each heat sink and the outer current rail

Diode 2 (exciter diode)
Test probes: to each heat sink and the middle current rail

Diode 3 (pos. diode)
Test probes: to each heat sink and the inner current rail

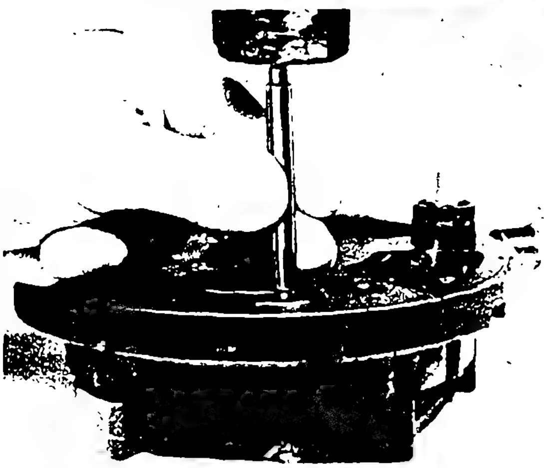
Ground short-circuit test of heat sink and terminals may only be carried out with the diodes unsoldered (otherwise they could be destroyed).



14

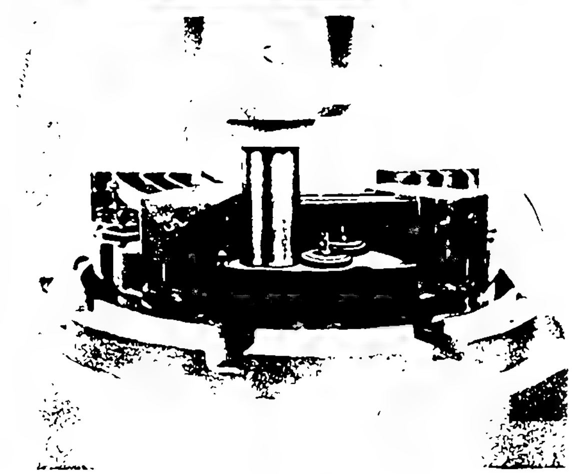
Replacing faulty diodes

Unsolder connection of faulty diode. During unsoldering open up tag on connection rail with long nose pliers Fig. 14



15

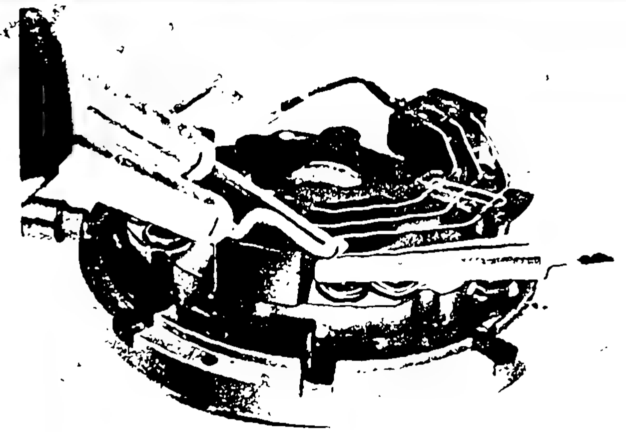
Turn flange over and with suitable punch **carefully** tap out diode: **Do not damage current rail.** Fig. 15



16

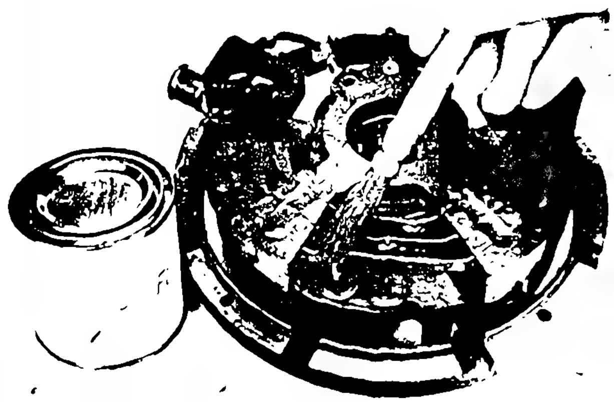
Before pressing in the new diode brush the seat of the heat sink with silicon oil Ol 63 v 2. Place flange on suitable support (e.g. on 1 695 720 047: clamping device for K 1 alternators).
Insert diode exactly upright, not askew, in heat sink bore, place mandrel EFLJ 57A/0/1 over the top and press in carefully; do not tilt! Fig. 16
After pressing in, check the diode separately.

W2E 31514
Seite 7



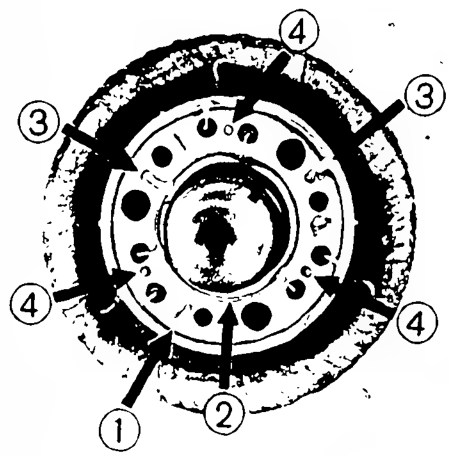
17

Place diode connection wire under tag, close tag and solder. To protect diode from heat grip wire with a pair of flat nose pliers. Fig. 17



18

Treat all blank parts of the rectifier flange such as heatsinks, diodes and current rails with anti-corrosion lacquer VS 9994 Fl. Fig. 18

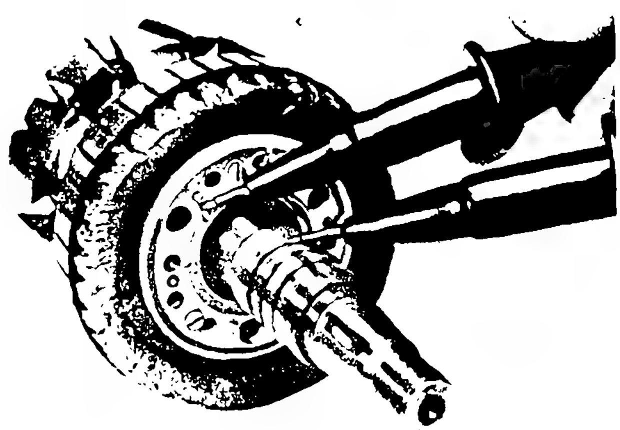


19

4.3 Rotor

Outer ring:	1
Inner ring:	2
Field winding:	3
Connection points:	4

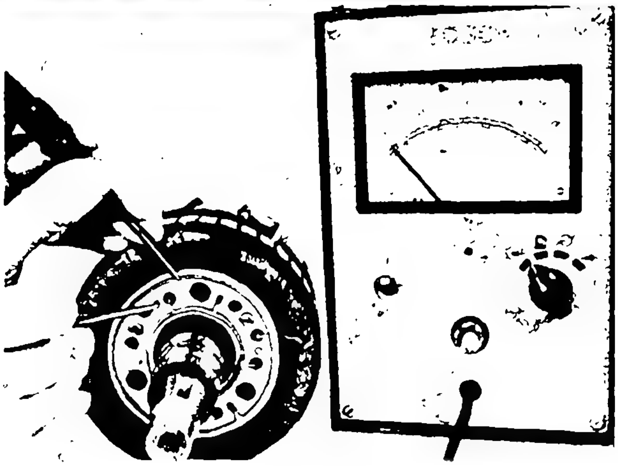
Clean off test points before electrical test. Fig. 19



20

Unsolder field winding from inner or outer ring.
Check winding for ground short-circuit.
Test voltage: 80 V AC.
Place one test probe to ground, the other in succession on each of the three connection points (4) and field winding.
Replace faulty rotor. Fig 20

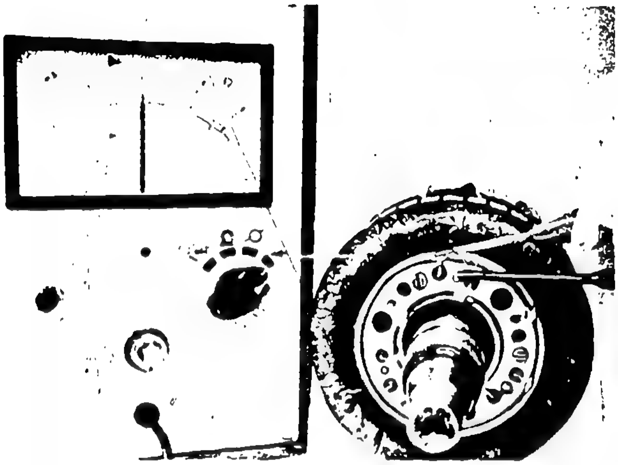
WDE 315 14
Seite 8



21

Diode checking with EFAW 192
Forward direction of diodes Fig. 21

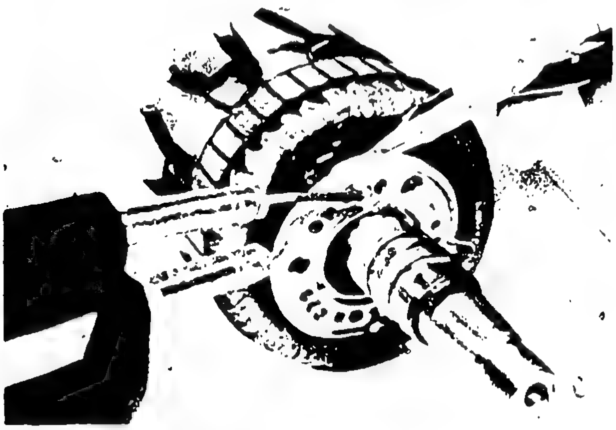
Function selector switch in position
Place one test probe on outer or inner ring, the other on each of the phase connection points in turn.
Forward direction of diodes is in order if needle points to left or right green sector (lower scale).



22

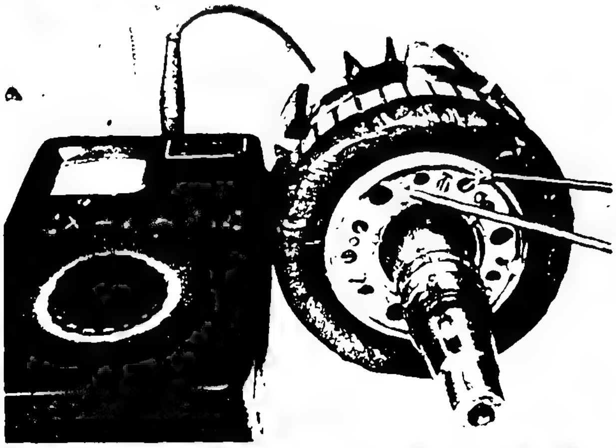
Inverse direction of diodes Fig. 22

Function selector switch in position
Place red test probe on outer ring, black probe on each of connection points in turn.
Positive diodes are in order in inverse direction when reading is nil to max. 0.8 mA.
Place black test probe on inner ring, the red probe on each of connection points in turn.
Negative diodes are in order in inverse direction when reading is nil to max. 0.8 mA.
For further details see operating instructions for alternator tester EFAW 192.



23

If diodes defective exchange complete ring. Fig. 23
Loosen screws, unsolder 3-phase winding from connection points and field coil ends from outer and inner ring respectively. Pull cable ends backwards using a pair of pliers. Solder in new diode ring, positioned correctly, and secure with screws. Paint ring with lacquer Fl 57 v 13.



24

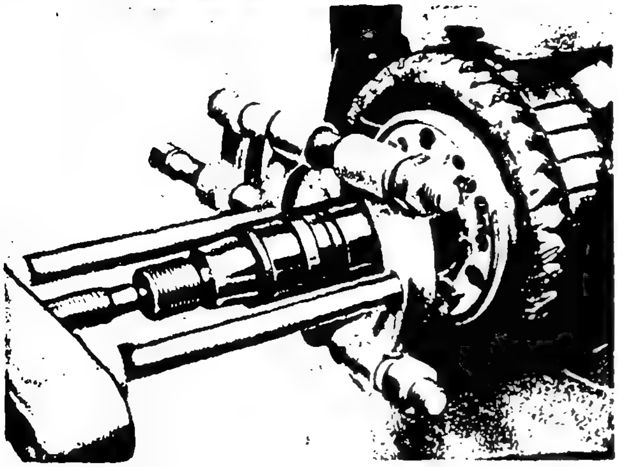
Check winding resistances with ohmmeter. Fig. 24
Measure field winding resistance between unsoldered cable and inner or outer ring.

Measure the 3-phase winding resistances between connection points (phase leads).
Resistance values:

field windings	0.3 Ω + 10 %
phase windings	9.0 Ω + 10 %

Resistance measurements may also be carried out with alternator tester EFAW 192; see para. 4 and 5 of operating instructions.

WJE 26514
Seite 9

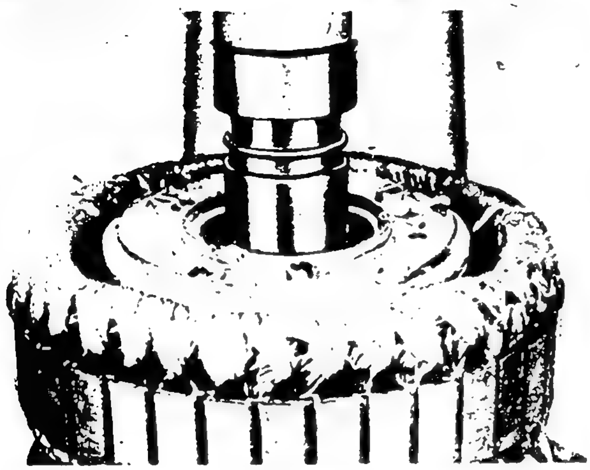


25

4.4 Replacing roller bearing in rectifier flange

Extracting the rings Fig. 25

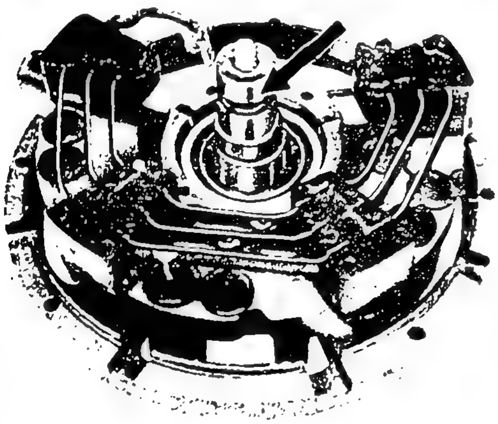
Place rotor in clamping support. Pull off intermediate ring, inner roller bearing ring and, if present, the second intermediate ring with extractor device. As a spring clip stands proud of shaft diameter, do not position jaws of extractor too far up the shaft.



26

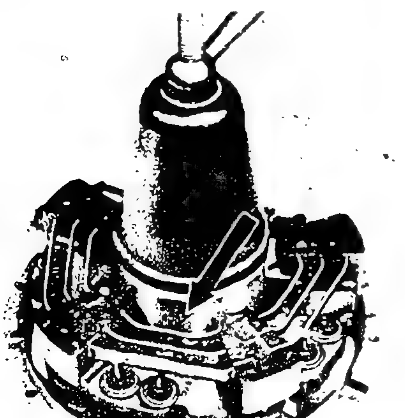
Pressing on the rings Fig. 26

Place drive-end of rotor on arbor press.
Use new inner roller bearing ring and replace worn intermediate rings.
Press intermediate ring with bevelled inner bore on the right way (is pressed over spring clip). Press on inner bearing ring and second intermediate ring, if on hand.



27

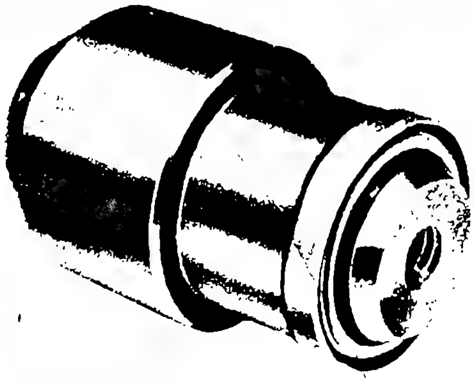
Insert expanding jaw EF 3108 (arrow) into bearing from radial seal side . . . Fig 27



28

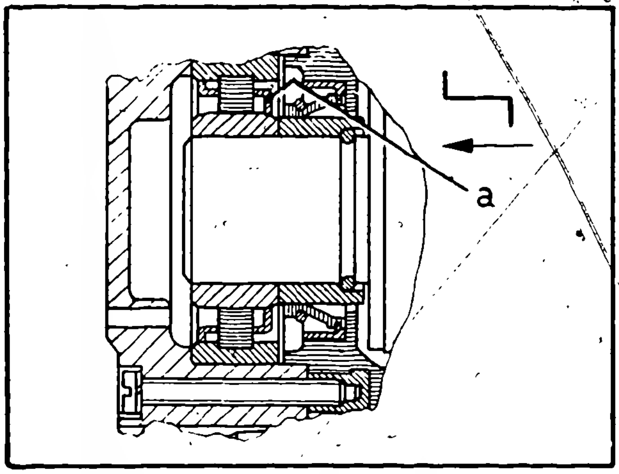
. . . and using puller bell EF 3042 pull out roller bearing. Use intermediate ring (arrow) if required. Fig. 28

W3B 31514 Seite 10



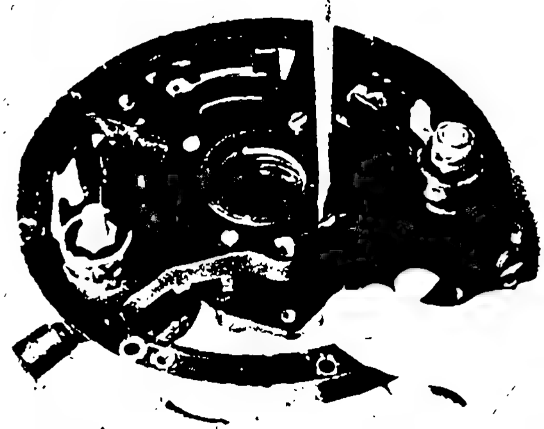
29

Remove radial seal ring with suitable tool. Press home new radial seal, the right way round, with mandrel EFLJ 64.
Grease sealing lips with Ft 1 v 34. Fig. 29



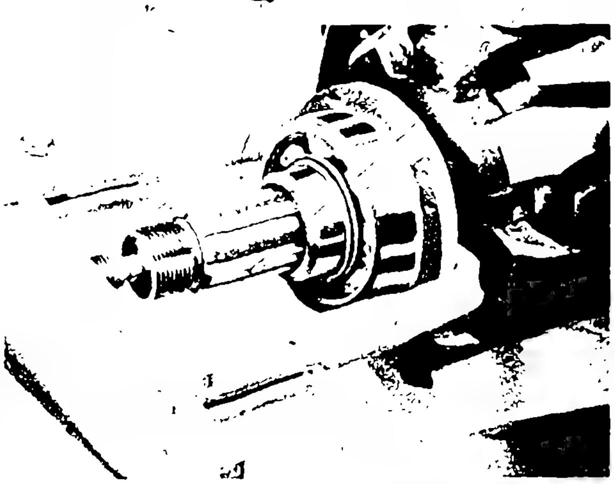
30

Fit roller bearing. Ensure that ball cage is inserted the right way round.
Grease bearing with Ft 1 v 34.
It is absolutely essential to use only the prescribed bearing quality C 3, as given in the service parts list.
Note: When pressing in bearing the sleeve used must only press on the outer ring. Fig. 30



31

Replace defective bearing cover (with cable connection). Fig. 31
The cover is supplied with fitted radial seal.

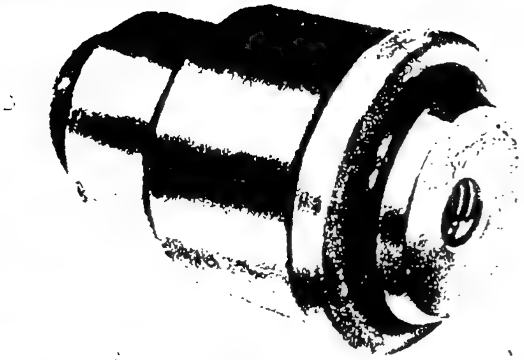


32

4.5 Replacing the drive end ball bearing

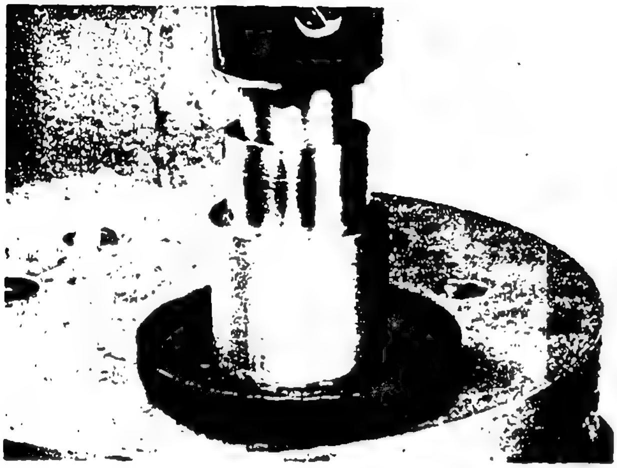
Place rotor in clamping support. Remove ball bearing. Do not re-use removed ball bearing. Fig. 32

WJE 31514
Seite 11



33

Remove defective radial seal ring from the thrust bearing.
Place new seal on mandrel EFLJ 64, (fit right way round) . . . Fig. 33

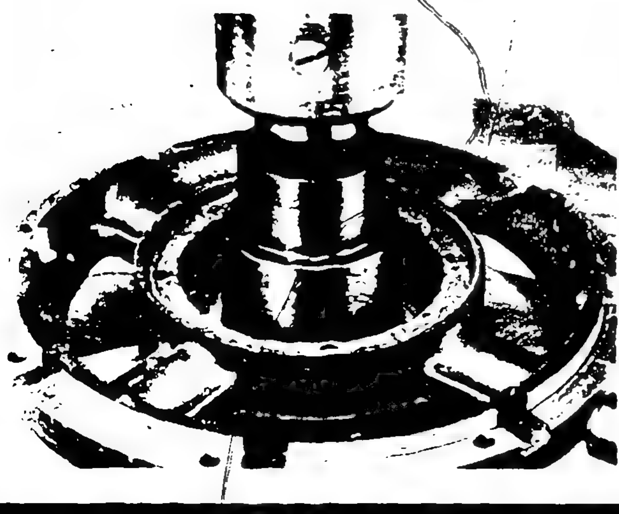


34

. . . and press into thrust bearing with arbor press.
Grease seal lips with Ft 1 v 34. Fig. 34

35

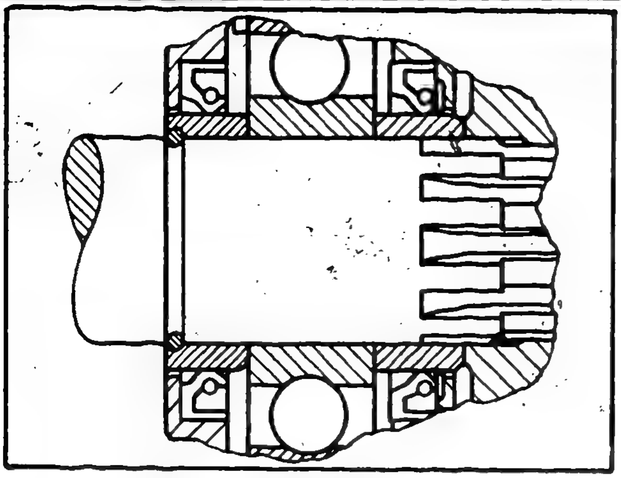
Remove radial seal ring from the drive end frame. Place new seal on mandrel EFLJ 64, (fit right way round) . . . Fig. 35



36

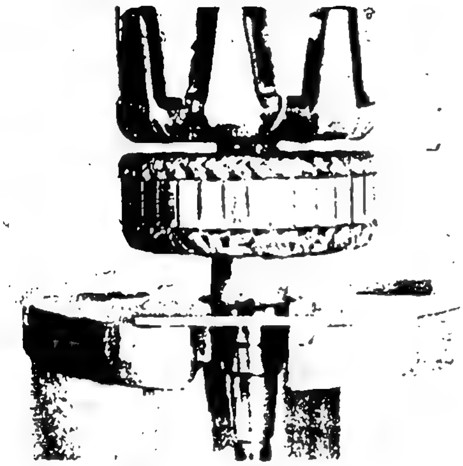
. . . and press into drive end frame with arbor press.
Grease seal lips with Ft 1 v 34.
Lightly grease ball bearing seat with Ft 70 v 1. Fig. 36

WSE 32514
Seite 12



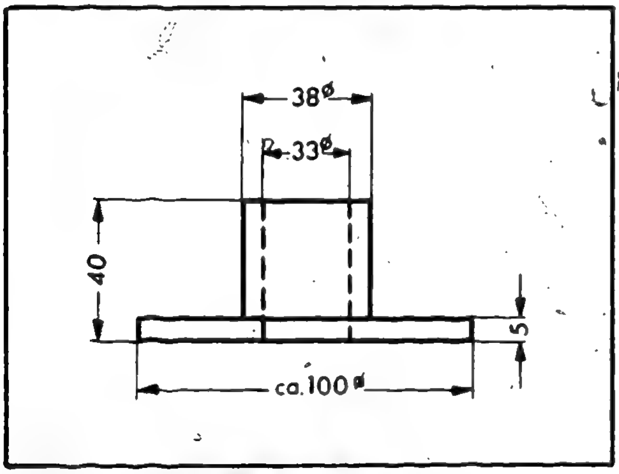
37

Fig. 37 shows correct positional fit of radial seal rings in drive end frame. Fig. 37



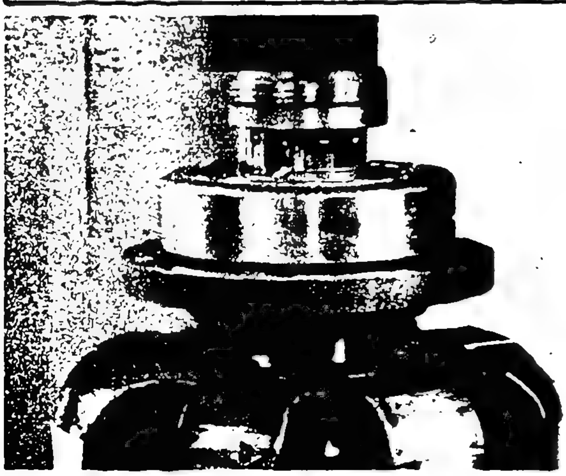
38

Place rotor on arbor press with suitable support (dimensioned sketch see Fig. 39). Fig. 38



39

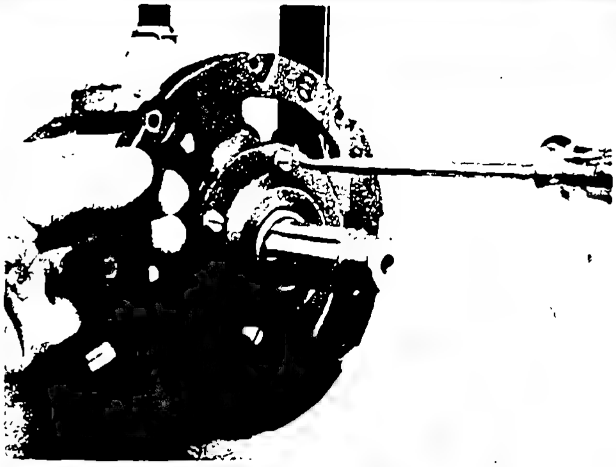
Suitable support for protection of diode ring when placing rotor on the arbor press. Fig. 39



40

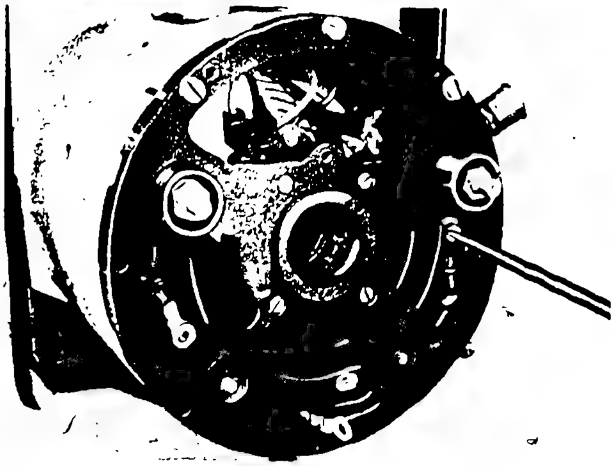
Position thrust bearing. Grease on side of ball bearing with Ft 1 v 34 prior to pressing on. Only use a bearing of quality C 3. Use suitable sleeve to press on ball bearing. Place spacer with 20° chamfer uppermost.
Damaged spacer (e.g. scored) must be replaced. Fig. 40

WJE 31514
Seite 13



41

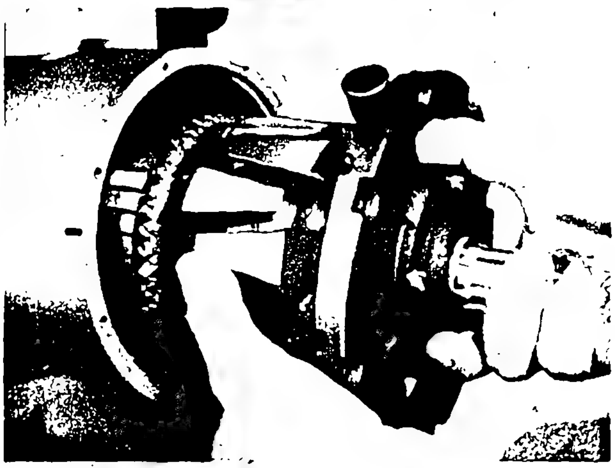
Place rotor in clamping support. Put drive end frame in position and screw to thrust bearing. Screw holes are offset. Fig. 41



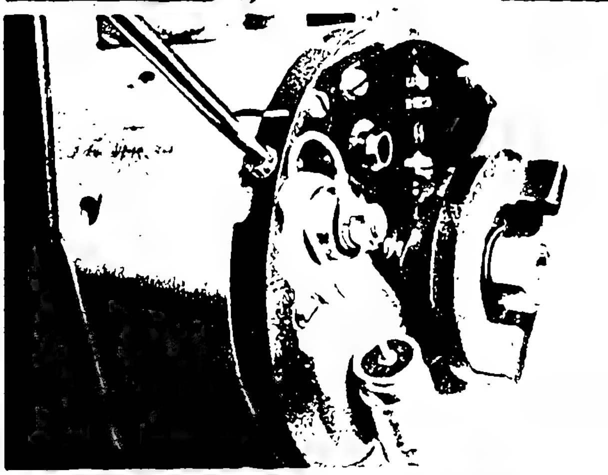
42

5. Assembly

Clamp field frame. Place rectifier bearing frame in position, paying attention to markings, pass 3-phase leads through and secure frame with 3 screws to the regulator recess. Tighten the 3-phase leads. Ensure that connection surfaces of heat-sinks are clean. Fig. 42
After screwing on, treat blank parts with anti-corrosion lacquer VS 9994 Fl.
Screw on duct cover.
Push spade connections onto regulator and screw on regulator.
Secure capacitor and earth strap.
Swivel housing and screw the 3 leads to the bearing cover.
Treat lead connection with anti-corrosion lacquer VS 9994 Fl.
Insert rotor carefully. Line up markings on flange and screw tightly. Fig. 43
Check rotor for free running.
Place fan and belt pulley in position. Do not omit key.
Tighten nut:
Torque 12–15 kgf.m (85–110 ft lb)
In alternators with shaft stubs at both ends insert key and secure half coupling.
Torque 7–9 kgf.m (50–65 ft lb).



43



44

6. Lubrication after completed repair

Fill grease cups at drive and regulator end with grease Ft 1 v 34 and screw them completely home twice. Also in place of plug screw fit grease cup and similarly lubricate with two full cups, then replace with plug screw and screw tight. The grease cup caps should be screwed hand-tight. Fig. 44

WSE 31514
Seite 14

7. Technical data

Resistance values

3-phase stator windings	0.16 Ω + 10 %
Field stator windings	8.0 Ω + 10 %
3-phase rotor windings	9.0 Ω + 10 %
Field rotor windings	9.3 Ω + 10 %

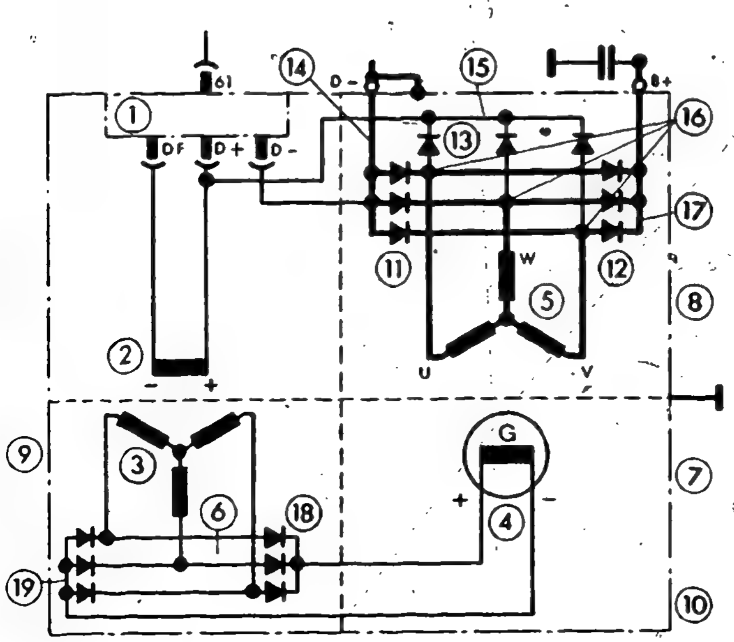
Torque values

Belt pulley nut	12...15 kgf.m (85–110 ft lb)
coupling nut	7... 9 kgf.m (50– 65 ft lb)

8. Testing the alternator

Test completely assembled alternator

Test instructions	VDT-WPE 315/1 B and 315/2 B
Test specifications	VDT-WPE 315/10–1 B
Transistorized regulator	VDT-WPE 320/2–13 B



Circuit diagram

1. Transistorized regulator
2. Field winding (stator)
3. 3-phase winding (rotor)
4. Field winding (rotor)
5. 3-phase winding (stator)
6. Diode ring
7. Rotor
8. Stator
9. Exciter generator
10. Generator
11. Negative diodes
12. Positive diodes
13. Field diodes
14. Outer current rail
15. Middle current rail
16. Heat sinks
17. Inner current rail
18. Outer ring
19. Inner ring

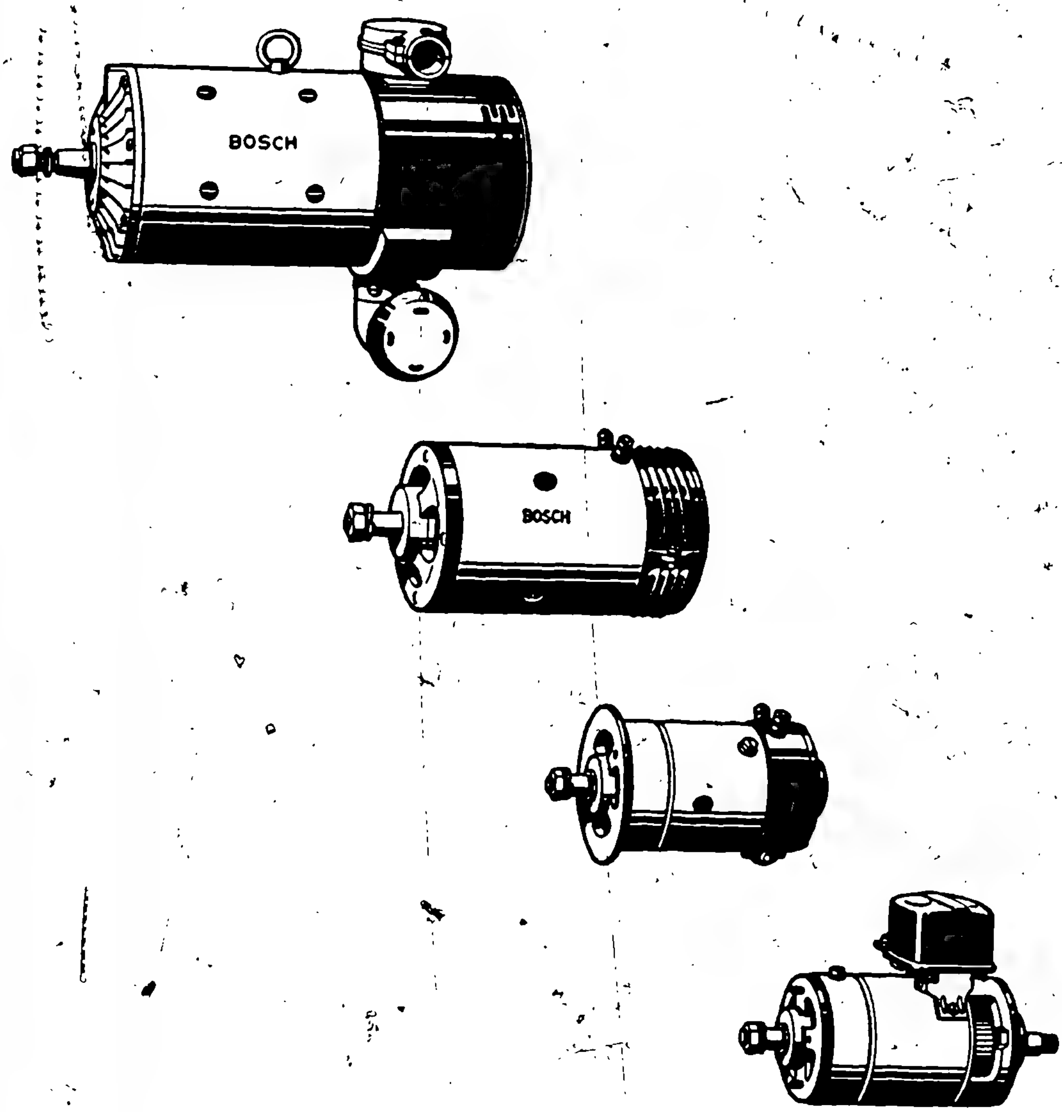
BOSCH

TESTING INSTRUCTIONS

VDT-**WPE 310/3 B** / U

Edition 1.69 Replaces 1.66

D.C. GENERATORS



ROBERT BOSCH GMBH STUTTGART GERMANY

8 25

B25

1. GENERAL

The "Test-Specifications for Generators" consist of these testing instructions VDT-WPE 310/3 B and the test specification sheets VDT-WPE 310/3..B. The test specifications for all current Bosch DC generators are contained in these instructions (for test specifications for older generators, refer to VDT-WPE 310/1 of January 1954).

Test specifications for the corresponding regulator are given the testing instructions VDT-WPE 320/1 B and 320/2 B.

2. EXPLANATION OF TYPE MARKING

Example:

T L M ( ) 28V 62A 11

- 11 — Rated speed (r.p.m.) in hundreds at 2/3 max. current
- 62A — Max. current in amps.
- 28V — Rated voltage in volts
- ( ) — Direction of rotation (looking on the drive end)
  - → or R = clockwise
  - ← or L = counter clockwise
  - ↔ or RL = clockwise or counter clockwise
- M — M = Intensified interference suppression
- L — L = fan built in; W = Water proof; Z = For trains
- T — Yoke diameter in mm

D = 65–79	J = 110–119	Q = 140–169
E = 80–99	K = 120–139	T = 170–199
G = 100–109		U = over 200

3. NECESSARY TEST INSTRUMENTS

		Part No.
Generator test bench	EFLJ 20 C	0 680 110 001
	EFLJ 25 C	0 680 110 004
Test and transformer panel	EFAW 81	0 681 169 013
and	EFAW 82	0 681 169 014
Winding shorted-turns tester	EFAW 90	0 681 169 034
or	EFAW 95	0 681 169 020
Spring balance Measuring range 0...1.2 kg	EF 1244 A	0 681 400 005
Ohmmeter		commercially available

4. TESTING INSTRUCTIONS

4.1 General

The generators are listed in the order of yoke size, voltage, output and speed. The rotating direction of the generator must agree with that indicated by the arrow on the yoke.

In testing with the related regulator, correct connections and polarity must be carefully observed. The no-load speed for rated voltage output and the rated speed (cold and warm) can be measured without the regulator. Terminal DF must be connected directly to either terminal D– or D+, depending on the internal wiring of the generator. (Only in this way can the possibility of a defective regulator affecting the test results be eliminated.) Make sure that the rated speed with the rated voltage is not considerably exceeded which would damage the exciter winding. It is advised to connect the regulator during continuous operation to prevent the voltage from rising too high. The endurance test at double the rated speed must be carried out with a regulator connected. If the generating system is unsatisfactory, the regulator should always be checked.

Generators with attached water pumps should only be tested when the pump is properly connected in a water circuit (filled water tank with inlet and outlet) or when the impeller with the carbon packing is removed from the pump.

4.2 Mechanical test

To test the brush pressure, lift the pressure spring from the carbon brush at the point of contact with spring scale EF 1244 (0 681 400 005).

4.2.1 The brush pressure must lie within the following limits:

Generators	Brush Pressure g
RD, LJ/RD	450...550
RE, LJ/RE, LJ/GE	450...600
LJ/CGE, LJ/GG (V)	450...600
LJ/CJE, RJ, LJ/RJ, LJ/GJH, GJJ, LJ/GJJ	450...600
LJ/GJM	600...700
RKC, LJ/RK, LJ/GK	600...800 Rated volt. 6 V and 12 V 800...1100 Rated volt. 24 V
LJ/GQ, LJ/ZQ, LJ/GT, LJ/ZT	750...950
LJ/GUL	950...1050

4.2.2 The armature end play must lie within the following limits:

Generators	Armature End Play mm
RD, LJ/FD	0.1...0.2
RJJ, LJ/RJJ, GJJ, LJ/GJJ	0.1...0.3
RKC, LJ/RK, LJ/GK, LJ/GQ, LJ/ZQ	0.12...0.25

It is not necessary to measure the armature end play on generators with deep-groove radial ball bearing.

4.3 Electrical test

4.3.1 Run the generator as a motor for a short period. The mechanical connection between the generator and the test bench driving motor must first be disengaged. Connect battery directly to terminal D+ (61). The generator must run as a motor in its normal direction of rotation (thus being polarized at the same time).

4.3.2 Rated voltage speed without load

Connect voltmeter across terminal D+ (61) and ground or D– if the return line is isolated. Increase speed gradually. At the no-load rated voltage speed, the generator voltage should be obtained ("cold").

Speed with load, "cold";
ambient temperature about 20°C.

Speed with load, "warm";
housing temperature about 60°C.

4.3.3 Load setting

The load setting always corresponds to 2/3 max. current. For the performance test, the test stand loading rheostat should be increased until the load current is achieved; read the corresponding speed and compare with the test specification. If the prescribed electrical values are not achieved, the following must be tested:

5. COMMUTATOR AND CARBON BRUSHES

5.1 There must be no pitting on the commutator. The brush contact track should be run in uniform and well (ground down).

5.2 No commutator arcing should occur at normal operating speeds (load setting).

5.3 The insulation between the commutator segments should not protrude above the surface. (Undercut the segment insulation with commutator EFAW 10. See VDT-WJE 011/1 B Allg. (general)).

5.4 The maximum permissible out-of-round of the commutator is 0.03 mm. If the commutator must be turned down, the minimum diameter as given in VDT-WJE 310/1 B should be observed.

5.5 The carbon brushes must not be worn excessively and should slide easily in the brush holders.

6. ARMATURE

6.1 The armature must not scrape the pole shoes or the exciter winding. The maximum permissible eccentricity of the armature lamination stack is 0.05 mm.

6.2 Test the armature for shorted-turns with tester EFAW 90 or 95.

6.3 Test the armature for open circuit with 2 V on ammeter (up to 60 A measuring range) connected in the circuit. The deflection on the instrument should be the same from segment to segment. Large deviations indicate the probability of an open circuit.

6.4 Test the commutator and winding for short circuit to ground with EFAW 81 and 82. The test lamp must not light up.
For 6 and 12 V armatures, test voltage of 40 V AC,
for 24 V armatures, test voltage of 80 V AC.

7. WINDINGS IN YOKE

7.1 Remove all ground connections. Check all windings and resistances in the yoke with EFAW 81 and 82. The lamp must not light up.
For 6 and 12 V generators, test voltage of 40 V AC,
for 24 V generators, test voltage of 80 V AC.

7.2 Measure the ohmic resistance of the exciter coil and the damping resistor with an ohmmeter or a voltmeter and ammeter. Any resistors connected in parallel will give an incorrect value. If there are several windings, one end from each should be released from its terminal and connected alone to the measuring instrument.

Observe the wiring diagrams on page 4. If there is an ohmmeter available for testing, it can be connected instead of the voltmeter. Battery, voltmeter and ammeter would then be unnecessary for these tests.

When measuring with a voltmeter and ammeter, only the battery voltage corresponding to the rated voltage of the generator should be used. That is to say, never measure a 6 V winding with 12 V or 24 V. The resulting excessive current could damage the winding and cause incorrect results due to overheating. It is likewise not advisable, in considerations of accuracy, to test, e.g., a 12 V winding with 6 V.

Also measure the individual coils of the exciter winding. Their resistances should be the same.

To calculate the ohmic resistance:

$$\text{Resistance (R)} = \frac{\text{Voltage (V)}}{\text{Current (I)}}$$

Example:
V = 6 V and I = 2 A; the resistance $R = \frac{6\text{ V}}{2\text{ A}} = 3$ Ohms.

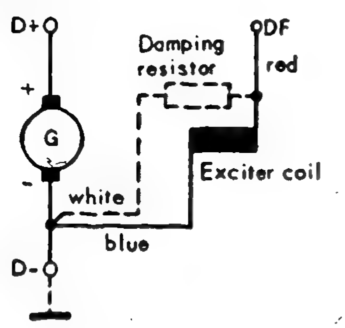
8. BEARING

Ball-bearings must not show any indentations, cracks, grooves or rust nodules on the bearing races. Unusable plain bearings (compo bushings) should be exchanged in accordance with VDT-WJA 021/2 B. Lubricate the bearing in accordance with VDT-WJE 310/2 B.

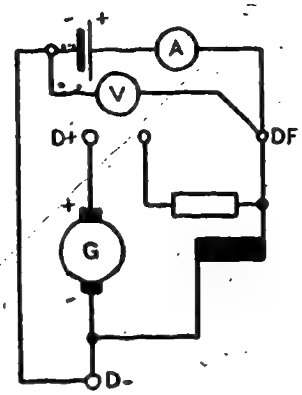
Deep-groove radial ball bearings are not always pressed onto the armature shaft but sometimes have a sliding seat. These bearings are pressed in with a spacer ring from the belt pulley end.

WIRING DIAGRAMS FOR TESTING THE WINDINGS IN THE YOKE

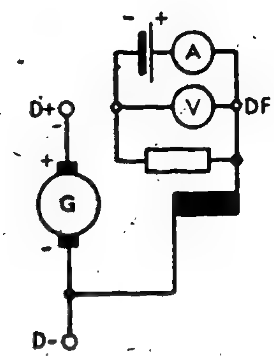
Wiring of generator



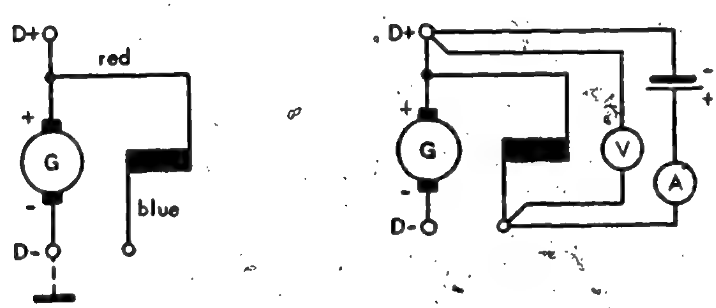
Measuring the exciter coil



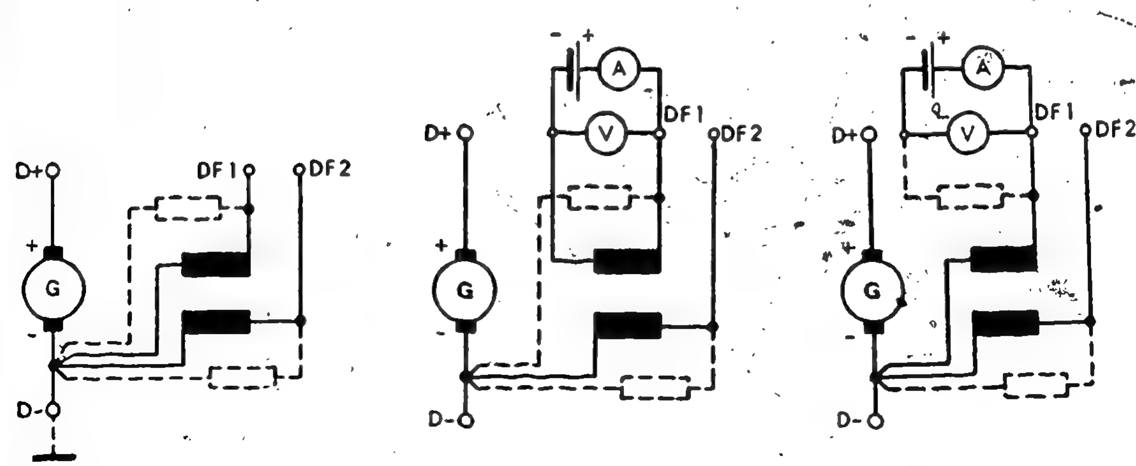
Measuring the damping resistor



With single-stage regulator (generator rotating clockwise)



With two-stage regulator (generator rotating clockwise)



With double-field single-stage regulator (generator with two field windings)
(If the double-field regulator (N-regulator) is replaced by a KE-regulator, VDT-BME 322/9 B RS should be observed.)

BOSCH

GERMANY

TEST SPECIFICATIONS

10

VDT-WPE 310/3-1 B

Ed. 2 ~~9.70~~

D.C. Generators 0 101 100 . . to 2 . .

Part Number: Type Marking	or	Former Designation	Rev/min Specifications: Generator no-load voltage rev/min	Output Test cold rev/min	Output Test warm rev/min	Load current A	Resistance: Field Winding Ω ±10%	Resistance: Damping Resistor Ω
0 101 100 . .								
	RD, LJ/RD	15/6/1900	1700	1900	2000	2,5	2,7	—
		45/6/2400	1550	2350	2550	7,5	2,7	—
0 101 2 . .								
		75/6/2000 [1]	1200	1750	1900	12,5	1,2	—
		75/6/2000 [2]	1550	1950	2000	12,5	1,2	—
		90/6/2000	1450	2000	2050	15	1,2	—
		90/6/2100 (F) [2]	1800	2150	2200	15	0,8[4]	—
		7 V 23 A 23 [2]	1850	2250	2400	15,5	0,8[4]	—
		90/6/2200	1100	1900	2100	15	1,2	—
		90/6/2300	1600	2200	2350	15	1,2	—
		130/6/2200	1450	2250	2300	22	1,2	—
		130/6/2600	1550	2500	2700	22	1,2	—
	LJ/GE (M)	130/6/2600	2100	2900	3000	22	1,2	—
		160/6/2200	1650	2250	2300	27	1,2	—
	LJ/GEF (M)	160/6/2500	1450	2450	2600	27	1,2	—
E	LJ/GEG (M)	7 V 40 A 28	1500	2500	2700	27	1,2	—
ED	(S)	160/6/2500	2100	3100	3200	27	1,2	—
		180/6/2300	1500	2200	2300	30	1,0	—
EF	LJ/GEH	180/6/2500 (F) [2]	1750	2500	2600	30	0,8[4]	—
	RED	7 V 45 A 27 [2]	1850	2600	2800	30	0,8[4]	—
EG	REE	200/6/2400 (F) [2]	1550	2300	2400	33,5	0,8[4]	—
		7 V 50 A 25 [2]	1650	2450	2600	33,5	0,8[4]	—
EH	LJ/RED	200/6/2600	1750	2550	2650	33,5	1,0	—
EW	LJ/REF	7 V 50 A 28	1850	2700	2900	33,5	1,0	—
	LJ/REG	75/12/1800	1250	1800	1900	6,5	4,8	—
		14 V 9 A 20	1200	1750	1900	6,5	3,5	—
	LJ/REH	90/12/1800 (F) [2]	1250	1700	1850	7,5	3,5	—
		14 V 11 A 19 [2]	1450	1850	1950	7,5	3,5	—
		90/12/2000	1450	1850	2000	7,5	4,8	—
		14 V 11 A 22	1400	1800	2000	7,5	3,5	—
		90/12/2100 (F) [2]	1800	2100	2200	7,5	3,5	—
		90/12/2300	1800	2200	2300	7,5	4,8	—
		90/12/2400	2000	2400	2500	7,5	4,8	—
		14 V 11 A 25	2100	2450	2600	7,5	3,5	—

Footnotes, see next page

C 1

~~423~~

Part Number: Type Marking	or	Former Designation	Rev/min Specifications: Generator no-load voltage rev/min	Output Test cold rev/min	Output Test warm rev/min	Load current A	Resistance: Field Winding Ω +10%	Damping Resistor Ω
0 101 20 . .								
		130/12/2200	1450	2050	2300	10,5	4,8	—
		14 V 16 A 24	1400	2000	2300	10,5	3,5	—
		14 V 16 A 26	2100	2550	2700	10,5	3,5	—
		160/12/2500	1900	2500	2800	13,5	3,5	—
		14 V 20 A 27	2050	2650	2800	13,5	3,5	—
	LJ/GE (M)	14 V 20 A 24 [3]	1780	2250	2450	13,5	3,5	—
	LJ/GEF (M)	160/12/2600	1900	2650	2800	13,5	4,8	—
		14 V 20 A 29	2100	2800	3000	13,5	3,5	—
E	LJ/GEG (M), (S)	160/12/2700	2050	2650	2850	13,5	4,8	—
ED		200/12/2400 (F) [3]	1650	2250	2500	17	3,5	—
EF	LJ/GEH	14 V 25 A 25 [3]	1800	2400	2600	17	3,5	—
EG	RED	200/12/2800 (F) [3]	1800	2500	2700	16,5	3,5	—
	REE	14 V 25 A 27 [3]	1950	2700	2800	17	3,5	—
EH	LJ/RED	200/12/2700 (F) [3]	1850	2600	2750	16,5	3,5	—
EW	LJ/REF	14 V 25 A 29 [3]	2100	2750	3000	17	3,5	—
	LJ/REG	240/12/2800 (F) [3]	2150	2750	2900	20	3,5	—
		14 V 30 A 30	2350	2950	3100	20	3,5	—
	LJ/REH	14 V 25 A 31 [3]	2100	2950	3200	17	3,5	—
		450 M 12/3700	2200	2950	3100	25	3,5	—
		14 V 38 A 32	2350	3100	3300	25,5	3,5	—
		90/24/2300	1900	2300	2400	7,5	21	60 ± 2
		28 V 6 A 24	1900	2400	2450	7,5	21	—
		160/24/2600	2000	2650	2750	6,5	21	60 ± 2
		28 V 10 A 27	2150	2700	2800	6,5	21	60 ± 2
		240 M 24/4200	3000	3400	3800	6,5	21	60 ± 2
		28 V 10 A 34	3000	3400	3800	6,5	21	—

[1]) With 15-groove armature
[2]) With 30-groove armature
[3]) Low-ohmic field, only use regulator with PTC resistor. (A-type)
[4]) Old field windings 6 V = 1,0 Ohm, 12 V = 4,8 Ohm

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50 (8.71)
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei

BOSCH

TEST SPECIFICATIONS

10

VDT-WPE 310/3-2 B
Ed. 2

Direct-current generators 0 101 300 .. to 40 ..

Part number	Type marking or Former designation		Rev/min specifications: Generator no-load voltage rev/min	Output test: cold rev/min	Output test: warm rev/min	Load current A	Resistance: Excitation winding Ω + 10 %	Resistance: Damping resistor Ω + 10 %
0 101 30 ..	G	7 V 10 A 21	1350	1850	1950	6,5	2,5	–
	GV	7 V 45 A 17[2]	1050	1600	1750	30	0,8	–
		7 V 50 A 24	1600	2400	2500	33	0,8	–
		14 V 11 A 25	2100	2400	2600	7,5	6,2	–
		14 V 11 A 34	2750	3400	3500	7,5	4,8	–
		14 V 12 A 18	1500	1750	1900	8	3,5	–
		14 V 16 A 17	1450	1650	1750	8	3,4	–
		14 V 16 A 21	1650	2100	2200	10,5	3,5	–
		14 V 25 A 23	1650	2300	2400	17	6,2	–
		14 V 30 A 20[4]	1350	2000	2100	20	3,5	–
		14 V 30 A 20[5]	1450	1900	2100	20	3,6	–
		14 V 30 A 25	1650	2450	2600	20	3,5	–
		14 V 38 A 19	1300	1850	1950	25	3,4	–
		14 V 38 A 23	1800	2350	2400	25	3,5	–
		14 V 42 A 20	1300	1950	2100	28	3,4	–
		14 V 42 A 22	1400	2100	2300	28	4,8	–
		28 V 25 A 38	3000	3750	3900	17	18	60 ± 3
	LJ/CGE	20/ 6/3000	2500	3050	3100	3	2,4	–
	LJ/GG (V)	45/ 6/1600	1000	1450	1700	7,5	2,2	–
	LJ/GGVR	60/ 6/1700	1200	1650	1750	10	2,0	–
		60/ 6/2000	1500	2000	2100	10	2,2	–
		75/ 6/1600	1400	1750	1650	12,5	1,84	–
		200/ 6/2300 (F)[2]	1500	2350	2400	33,5	0,8	–
		60/12/1800[1]	1500	1800	1900	5,0	6,2	–
		75/12/3200	2800	3150	3200	6,5	8,5	–
		90/12/2400	1950	2350	2500	7,5	6,2	–
		90/12/3000	2350	2950	3100	7,5	4,8	–
		100/12/1800	1500	1800	1900	8	4,8	–
		130/12/2000	1700	1950	2150	10,5	4,8	–
		160/12/1800	1200	1700	1900	13,5	6,2	–
		200/12/2200	1700	2150	2300	17	6,2	–
		200/12/2400	1700	2400	2500	17	4,8	–
		240/12/2100	1450	2050	2200	20	4,8	–
		240/12/2400	1700	2300	2500	20	4,8	–

[1]) Clamping and driving devices EF LM 4 A (0 681 221 002) for testing
[2]) Low ohmic field, only use regulator with PTC resistor (A type)
[4]) As from date of manufacture FD 124
[5]) Up to date of manufacture FD 124

C 3

Part number	Type marking or Former designation		Rev/min specifications: Generator no-load voltage rev/min	Output test cold rev/min	Output test warm rev/min	Load current A	Resistance: Excitation winding Ω + 10 %	Damping resistor Ω + 10 %
0 101 356 ..	JA	14 V 20 A 16	1400	1700	1800	13	4,8	–
		14 V 38 A 20	1400	2100	2200	25	4,8	–
		14 V 38 A 21	1400	2050	2150	25	3,5	–
		28 V 10 A 16	1350	1600	1650	7	17	–
		28 V 19 A 20	1400	1950	2050	12	17	–
	GJA	160/12/1500	1150	1450	1550	13	4,8	–
		300/12/1900	1150	1800	1950	25	4,8	–
		160/24/1500	1150	1450	1550	7	17	–
		300/24/1850	1150	1750	1900	12	17	–
0 101 35 ..	LJ/CJE[1])	45/ 6/1600	1150	1550	1700	7,5	2,4	–
	GJJ	60/ 6/1600	950	1500	1700	10	1,5	–
	LJ/GJH	60/ 6/1800	1200	1700	1850	10	2,3	–
	LJ/GJJ	90/ 6/ 900	600	900	950	15	2,1	–
	LJ/GJM	90/ 6/1800	1100	1650	1900	15	2,7	–
	RJH	130/ 6/1500	1050	1400	1500	22	2,1	–
	RJJ	130/ 6/2200	1200	1900	2100	22	1,4	–
	LJ/RJH	150/ 6/1600	1050	1400	1500	25	2,1	–
	LJ/RJJ	160/ 6/1500	1000	1500	1600	27	1,2	–
	LJ/RJM	160/ 6/1800	1200	1800	1900	27	1,2	–
		90/12/ 800	600	800	850	7,5	5,2	–
		90/12/1200	900	1200	1250	7,5	5,2	–
		130/12/1500	1150	1450	1550	11	5,2	–
		130/12/2000	1150	1700	1900	11	5,2	–
		150/12/1600	1200	1500	1550	13	5,2	–
		150/12/2100	1150	1850	2100	13	5,2	–
		160/12/1600	1100	1550	1650	13,5	5,2	–
		160/12/1800	1300	1800	1900	13,5	5,2	–
		160/12/2100	1150	1900	2200	13,5	5,2	–
		200/12/1800	1200	1800	1900	17	5,2	–
		240/12/1900	1300	1900	2000	20	4,8	–
		280/12/1800	1150	1750	1850	24	4,8	–
		300/12/1900	1150	1850	2000	25	4,8	–
		90/24/1200	950	1250	1400	3,5	19	60 ± 2
		130/24/1600	1350	1550	1700	5,5	19	60 ± 2
		160/24/1700	1350	1650	1750	7	19	60 ± 2
		300/24/1850	1150	1750	1950	12,5	17	60 ± 2

[1]) Clamping and driving devices EFLM 4 A (0 681 221 002) for testing

C4

Part number	Type marking or Former designation		Rev/min specifications: Generator no-load voltage rev/min	Output test cold rev/min	Output test warm rev/min	Load current A	Resistance: Excitation winding Ω + 10 %	Damping resistor Ω + 10 %
0 101 40 ..	KC	7 V 50 A 13	1200	1300	1400	33	1,4	–
	K	14 V 16 A 9	750	850	950	11	5,2	–
		14 V 25 A 10	700	950	1050	17	5,2	–
		14 V 25 A 13	1050	1300	1400	17	5,2	–
		14 V 25 A 15	1200	1450	1550	17	4,8	–
		14 V 31 A 11	850	1050	1200	21	5,2	–
		14 V 38 A 14	1000	1350	1450	25	4,8	–
		14 V 38 A 15	1200	1550	1600	25	4,8	–
		14 V 38 A 24	2100	2400	2500	25	4,8	–
		14 V 50 A 16	1150	1550	1650	33	4,8	–
		28 V 13 A 13	1150	1350	1450	9	18	–
		28 V 19 A 14	1200	1350	1450	13	18[3])	–
		28 V 19 A 16	1400	1500	1600	13	18[3])	–
		28 V 25 A 17	1450	1650	1750	17	18	–
		42 V 13 A 14	1200	1300	1400	9	33	120 ± 4
	RKC	130/ 6/ 900	550	800	950	22	2,6	–
	LJ/GK (M)	200/ 6/1300	1050	1250	1350	33	1,4	–
	LJ/GKW	130/12/ 825	650	800	850	11	5,2	–
		200/12/ 950	650	900	1000	17	5,2	–
		200/12/1350	900	1250	1350	17	5,2	–
		250/12/1000	750	950	1050	21	5,2	–
		300/12/1400	900	1250	1350	25	5,2	–
		300/12/1450	1100	1450	1500	25	4,8	–
		400/12/1500	1100	1450	1550	33	4,8	–
		450 M 12/2600	1950	2350	2400	25	5,2	–
		200/24/1200	1050	1250	1350	12	18[3])	60 ± 2
		300/24/1300	1050	1250	1350	12	18[3])	60 ± 2
		400/24/1600	1250	1550	1650	17	18	60 ± 2
		300/36/1300	1050	1250	1350	8	33	120 ± 2

[3]) Excitation winding produced before 1965: 22 Ω

BOSCH

TEST SPECIFICATIONS
10
VDT-WPE 310/3-3 B
Ed. 2
replaces 9.70

D. C. Generators
0 101 500 . . up to, and including 0 101 700 . .

Part Number: Type Marking	or	Former Designation	Specifications: Generator no-load voltage rev/min	Output Test cold rev/min	Output Test warm rev/min	Load Current A	Resistance: Excitation Winding Ω ± 10%	Damping Resistor Ω
0 101 50 . .								
		300/12/900	620	820	900	25	6,2	–
		300/12/950	800	900	1000	25	6,2	–
		14 V 38 A 10	900	1000	1050	25	6,2	–
		400/12/1000	800	950	1050	33,5	6,2	–
		400/12/1150	860	1060	1100	33,5	6,2	–
		400/12/1300	1050	1200	1300	33,5	6,2	–
		600/12/1400	1050	1350	1450	50	6,2	–
		14 V 75 A 15	1050	1450	1550	50	6,2	–
		14 V 85 A 16	1050	1600	1700	60	6,2	–
		14 V 165 A 28	2250	2800	2900	110	6,2	–
		2000 M 12/2800[1])	2000	2250	2400	110	R 3:2x7	–
		14 V 167 A 28	2300	2800	2900	110	R 16:2x5,9	–
		28 V 19 A 8	680	800	850	13	9	–
		300/24/1200	925	1080	1200	12,5	26	60 ± 2
Q	LJ/GQ	400/24/1200	1000	1150	1250	17	19,5	60 ± 2
QL	LJ/GQL	28 V 25 A 13	1050	1300	1350	17	19,5	–
QW	LJ/GQW	400/24/1600	1400	1550	1650	17	19,5	60 ± 2
		28 V 25 A 17	1400	1600	1750	17	19,5	–
QZ	LJ/ZQ							
		450 M 24/1000	750	1000	1050	17	19,5	60 ± 2
		28 V 19 A 10	850	1050	1100	17	19,5	–
		600/24/1300	1000	1250	1350	25	19,5	60 ± 2
		28 V 38 A 14	1050	1350	1450	25	19,5	–
		700/24/1400	910	1350	1450	28	19,5	60 ± 2
		28 V 42 A 15	1100	1500	1600	28	19,5	–
		700 M 24/2600	1200	1650	1860	19	15	60 ± 2
		28 V 29 A 20	2050	1350	2100	19	15	–
		28 V 38 A 14	1050	1350	1450	25	19,5	60 ± 2
		1000 M 24/2600	2050	2350	2650	42	24	–
		28 V 42 A 24	2200	2400	2500	28	24	–
		1000 M 32/2600	2000	2550	2750	31,5	33	120 ± 4
		1600 M 32/2600	1850	2050	2250	34,5	33	120 ± 4
		700/48/1300	1050	1250	1300	14,5	36	–
0 101 60 . .								
		700/12/700	450	650	700	58	2x6,2	–
		700/12/1000	650	1000	1050	58	6,2	–
		14 V 85 A 11	750	1050	1150	56,5	6,2	–
		700/12/1500	1150	1450	1500	58	6,2	–
T	LJ/GT	14 V 85 A 15	1300	1500	1600	56	6,2	–
TL	LJ/GTL	1000/12/1600	1150	1600	1650	83	6,2	–
		14 V 110 A 16	1200	1550	1650	73	6,2	–
TW	LJ/GTW							
		500/24/900	750	1000	1050	21	18,5	60 ± 2
	LJ/ZT	600/24/750	600	750	800	25	24	60 ± 2
		600/24/950	900	950	1000	25	18	–
		28 V 38 A 11	1050	1100	1200	26	18	–
		700/24/975	800	1000	1050	28	18,5	60 ± 2
		28 V 42 A 10	800	1000	1050	28	18,5	–

Footnotes, see next page

C6

Part Number			Specifications			Load Current	Resistance	
Type Marking	or	Former Designation	Generator no-load voltage	Output Test cold	Output Test warm		Excitation Winding	Damping Resistor
			rev/min	rev/min	rev/min	A	Ω ± 10%	Ω
0 101 60 . .								
		750 M 24/800	600	700	750	21	24	60 ± 2
		900 M 24/1250	1050	1150	1250	37	18,5	60 ± 2
		28 V 38 A 13	1250	1300	1350	25	18,5	–
		1000/24/700 2)	550	700	750	42	2x17	–
		1000/24/850	750	850	900	42	2x18	–
		28 V 62 A 10	950	1000	1100	41	2x18	–
		1000/24/1000	900	1000	1050	42	18	–
		28 V 62 A 11	1050	1150	1200	41	18	–
		1000/24/1050	900	1000	1050	42	2x18	–
		28 V 62 A 12	1100	1250	1300	41	2x18	–
		1000/24/1275	1050	1250	1350	42	18,5	60 ± 2
		28 V 62 A 14	1200	1400	1450	41,3	18,5	–
		1300/24/1100	900	1090	1150	54	9	–
T	LJ/GT	28 V 81 A 12	1050	1250	1300	54	9	–
TL	LJ/GTL	1300/24/1400	1090	1350	1500	54	18,5	60 ± 2
TW	LJ/GTW	28 V 81 A 15	1250	1500	1600	54	18,5	–
	LJ/ZT	1600 M 24/2500	2100	2400	2500	67	22	60 ± 2
		1000/30/900	700	900	950	33,5	30	–
		1000/30/1250	1100	1300	1350	33,5	30	–
		700/32/900	750	900	950	22	30	–
		37 V 33 A 10	800	1000	1050	22	30	–
		1000/32/1250	1100	1250	1300	31	30	–
		37 V 47 A 14	1250	1400	1450	31	30	–
		1000/72/1150 3)	1200	1350	1400	18	70	–
		84 V 27 A 14 3)	1200	1350	1450	18	70	–
		84 V 21 A 14 3)	1300	1400	1500	14	70	–
		84 V 21 A 16 3)	1450	1550	1650	14	70	–
		1300/72/1200 3) 4)	1070	1150	1200	17	70	–
		84 V 21 A 13 3)	1200	1400	1550	18	70	–
		84 V 27 A 16 3)	1450	1600	1650	18	70	–
0 101 700 . .								
		1300/24/800	700	800	850	54	2x17	–
		28 V 83 A 9	850	900	950	55	2x17	–
		2000/24/950	750	950	970	83	2x9	–
		28 V 125 A 10	850	1000	1100	83	2x9	–
UL	LJ/GUL	2400 M 24/1100	720	960	1050	100	2x17	–
		2000/32/1300	1060	1250	1300	62	19,8	–
		1300/64/1100 3)	1000	1100	1150	20	66	–
		75 V 31 A 12	1150	1200	1250	20	66	–

1) With starting winding

2) Armature 2 104 017 121 (LJAN 9 L 3 Z) of generator 0 101 601 030 / ... 032 (LJ/GTL 1000/24/700 R 1 and R 5) has equipotential connections and cannot be tested for interturn short-circuit with testers EF 2666, EFAW 90 or 95.

3) Ground generator before testing and do not touch any live parts. Voltages above 60 volts are dangerous!

4) With solid state regulator

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50 (1 72)
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei

10

0 101 402 079 - K (R) 28V 19A 14
Breakdown of direct-current generators
in Büssing motor trucks

VDT-BME 311/85B LJ
<VDT-I-101/100 B>
Edition 9.1974
Translation of German
edition of 8.7.1974

In isolated cases generators in Büssing motor trucks break down because of damaged armatures. Commutator segments are thrown out and sometimes the armature shaft breaks.

The cause of this damage is the excessive bending force on the armature shaft. This occurs whenever the generator and the water pump are out of alignment and the coupling (Fig. 1) introduced by MAN/Büssing cannot compensate because of its excessive stiffness.

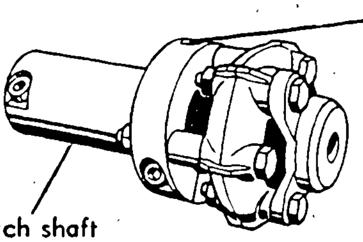


Fig. 1

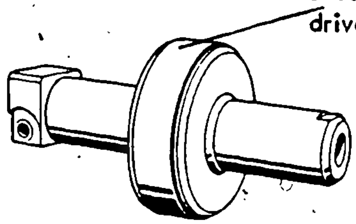


Fig. 2

The coupling previously used with Bosch driver 1 206 442 035 - ZKH 35/2 Z (Fig. 2) compensated for misalignment.

Remedial Measures

1. Accurately align the generator and water pump.
   To this end a pointer (welding rod or similar) can be used, which is stuck onto the clutch shaft with adhesive tape, and which very ne[illegible]reaches as far as the water pump shaft.
2. Test the coupling!
   When the coupling is fitted and the clamping ring screw backed off, the coupling must turn freely on the shaft. If necessary loosen the 6 fastening screws of the rubber ring. When retightening make sure that the rubber ring does not become warped. The hardness of the rubber may not exceed 55 Shore. This hardness value is printed into the rubber ring. Rings with a higher Shore hardness (e.g. 65) should be exchanged, since the coupling otherwise becomes too stiff and leads to armature damage.

Generator breakdowns with the armature damage described above do not constitute a warranty case. Repairs are the customer's responsibility.
In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K 1
Abteilung VAK 6

0 101 600.., 0 101 601.. and 0 101 602..
Change in the carbon brush set

VDT-I-101/101 B
4.1976

As from April 1975 (FD 524) the carbon brush sets have been changed from

1 107 014 113 and 2 107 014 000 to 2 107 014 012

and the brush springs from

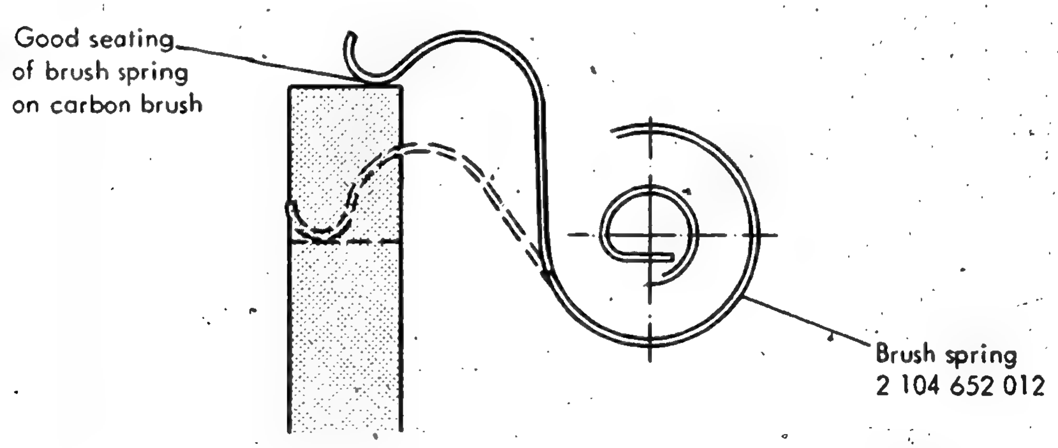
2 104 652 008 and 2 104 652 010 to 2 104 652 012.

The new carbon brush set has been available since October 1975 (FD 530).

The brush pigtails (shunts) are tamped into the new carbon brushes, which themselves have been increased in length from 30.5 to 33.5 mm.

The recently introduced brush spring 2 104 652 012 has been matched to the extended carbon brush.

If extended carbon brushes are fitted, and the old brush springs continue to be used, then perfect seating of the spring on the brush must be guaranteed. It must be ensured that the brush spring cannot slip down from the carbon brush (see fig.).



If perfect seating cannot be guaranteed, the brush springs 2 104 652 012 must be fitted.

In case of inquiry, please contact your authorized representative.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1 Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

BOSCH

GERMANY

VDT – WJA 021/3 B GEN
Edition 2. 70
Translation of German edition of 9.69
Traduction de l'édition allemande du 9. 69
Traducción de la edición alemana del 9. 69

REPAIR INSTRUCTIONS
INSTRUCTIONS DE RÉPARATION
INSTRUCCIONES DE REPARACION

Exchange of field coils

Remplacement des enroulements inducteurs

Cambio de los arrollamientos de excitación

ROBERT BOSCH GMBH STUTTGART GERMANY

C10

C10
1

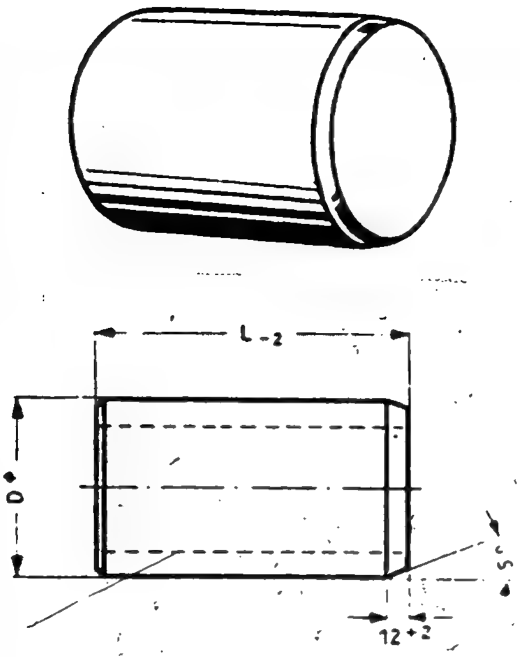


Fig. 1 **Drive-in tool**
Material: Euronorm Fe 37 (Fe 42) - B 3 FN

If necessary drilled to save weight.
Wall thickness 12-15 mm.
Mark diameter on front face.

Mandrin
Matériau: acier Euronorm Fe 37 (Fe 42) - B 3 FN

Prévoir éventuellement un alésage pour alléger la pièce.
Epaisseur de paroi: 12 à 15 mm
Porter la valeur du diamètre sur la face frontale.

Mandril de calar
Material: Acero Euronorm Fe 37 (Fe 42) - B 3 FN

Eventualmente, con agujero para ahorrar peso.
Grueso de pared 12...15 mm.
Marcar el diámetro sobre la cara frontal.

Fig. 2

General

When fitting the field coils in electrical units, the drive-in tools listed in the table must be used in order to obtain the prescribed air space between the pole shoes and the armature. Make up drive-in tool according to the sketch in Fig. 1.

Tools

Clamping block EFAW 9		0 681 269 007
Pole shoe screw driver with blades EFAW 9/4 A		0 687 952 005
Screwdriver blades (single)		
	9 mm	1 687 952 009
	12 mm	1 687 952 008
	15 mm	1 687 952 007

Removal

Mark the position of the pole shoes and the coil ends. Place field frame in clamp EFAW 9.

Place the pole shoe screw driver with appropriate screw driver blade in the spindle of the clamping block.

Place pole shoe screw driver blade in the screw slot and clamp up guide tube.

Undo pole shoe screws with 27 mm (1 1/16 in) wrench.

Thoroughly clean housing and pole shoes in petrol or trichloroethylene and blow off with compressed air.

Fitting

Gently warm the coils.

Place the coils with the pole shoes in the field frame and put the pole shoe screws in place. Note the markings.

Press in the appropriate drive-in tool between the pole shoes.

Lay field frame in the clamping block.

Tighten up the pole shoe screws with the pole shoe screw driver and press out the drive-in tool on a press.

Check the installed coils for ground connection or broken circuit.

Part number	Type	Previous désignation	Pole bore	Drive-in tool D (mm)	Drive-in tool L (mm)
Référence	Type	Désignation antérieure	Alésage polaire	Mandrin D (mm)	Mandrin L (mm)
Nº de pedido	Tipo	Designación anterior	Agujero polar	Mandril de calar D (mm)	Mandril de calar L (mm)
Dynamos **Motores de corriente continua**					
0 101 200 . . . to / à / hasta 300 . . .	ED, EF, EH, EG EW, G	RED, REE, REF REH, GEG, GEGS GEGM, GEH, REG CGE	56,55 + 0,06	56,55 $^{-0,01}_{-0,05}$	80
0 101 301 . . .	GV 14 V 11 A25	GGV 90/12/2400	62,8 + 0,074	62,8 $^{-0,01}_{-0,05}$	45
	GV 14 V 11 A34	GGV 90/12/3000	62,55 + 0,046	62,55 $^{-0,03}_{-0,08}$	45
0 101 302 . . .	G	GG	65,50 + 0,15	65,50 $^{-0,01}_{-0,05}$	80
0 101 350 . . .	–	CJE			
0 101 356 . . .	JA	GJA	71,3 + 0,3	71,3 $^{-0,01}_{-0,05}$	85
0 101 401 . . . to / à / hasta 404 . . .	KC, K	RKC, GK, GKM	80,6 + 0,06	80,6 $^{-0,01}_{-0,05}$	110
0 101 500 . . . to / à / hasta 505 . . .	Q, QL, QW, QZ	GQ, GQL, GQW, ZQ	94,78 + 0,07	94,78 $^{-0,01}_{-0,05}$	120
0 101 600 . . .	T	GT	115,8 + 0,08	115,8 $^{-0,01}_{-0,05}$	130
0 101 601 . . .	TL 14 V	GTL 12 Volt	116,0 + 0,054	116,0 $^{-0,01}_{-0,05}$	150
	TL 28 V	GTL 24 Volt	115,8 + 0,08	115,8 $^{-0,01}_{-0,05}$	130
	TL 37V, TL 84V	GTL 32 and 72 volt GTL 32 et 72 volt GTL 32 y 72 V	116,0 + 0,054	116,0 $^{-0,01}_{-0,05}$	150
0 101 602 . . . to / à / hasta 605 . . .	TW	GTL, ZT, GT, GTW	115,8 + 0,08	115,8 $^{-0,01}_{-0,05}$	130
0 101 700 . . .	UL	GUL	135,9 + 0,08	135,9 $^{-0,01}_{-0,05}$	190

Seite 4

Part number Référence Nº de pedido	Type Type Tipo	Previous designation Désignation antérieure Designación anterior	Pole bore Alésage polaire Agujero polar	Drive-in tool D (mm) Mandrin D (mm) Mandril de calar D (mm)	Drive-in tool L (mm) Mandrin L (mm) Mandril de calar L (mm)
Starter Démarreurs Motores de arranque					
0 001 100 . . . to/à/hasta 158 . . .	DD, DF	CD, CDD, EDD	52,7 + 0,3	52,7 -0,01 / -0,06	85
0 001 160 . . .	DG	–	52,7 +0,3 / -0,1	52,7 -0,11 / -0,16	85
0 001 200 . . . to/à/hasta 215 . . .	ED, EF, EB	EEC, EED, EEF, EEB	60,8 + 0,4	60,8 -0,01 / -0,06	100
			Additional press-out tool 10mm dia, 160 mm long Mandrin auxiliaire de démontage Ø 10, 150 de long Mandril de expulsión adicional 10 Ø, 150 largo		
0 001 304 . . . to/à/hasta 313 . . .	GD, GE, GF	EGD, EGE, EGF	66,1 + 0,4	66,1 -0,01 / -0,06	85
0 001 354 . . . to/à/hasta 358 . . .	JB, JD bis 3 PS	EJB, EJD	73,7 + 0,35	73,7 -0,01 / -0,06	85
0 001 359 . . . to/à/hasta 360 . . .	JD 4 PS	–	75,95 +0,3 / -0,1	75,95 -0,11 / -0,16	85
0 001 362 . . .	JF	–	75,95 +0,3 / -0,1	75,95 -0,11 / -0,16	85
0 001 380 . . .	–	PJD	73,7 + 0,35	73,7 -0,01 / -0,06	85
0 001 400 . . . to/à/hasta 402 . . .	KG	BNG	83,25 + 0,1	83,25 -0,01 / -0,06	100
0 001 410 . . .	KB	FKB	84,0 + 0,3	84,0 -0,01 / -0,06	100
0 001 500 . . . to/à/hasta 501 . . .	QD	BPD	95,4 ± 0,1	95,4 -0,01 / -0,06	100
0 001 510 . . .	QB	–	101,0 + 0,3	101,0 -0,01 / -0,06	100
0 001 600 . . . to/à/hasta 654 . . .	TB, TE, TF	FTB, FTE, FTF, DTB, DTG	136,2 ± 0,05	136,2 -0,06 / -0,12	120
Alternators Alternateurs Generadores trifásicos					
0 123 689 5 . .	T 4	–	126,0 +0,15 / -0,05	126,0 -0,06 / -0,12	120

Part number	Type	Previous designation	Pole bore	Drive-in tool D (mm)	Drive-in tool L (mm)
Référence	Type	Designación anterior	Alésage polaire	Mandrin D (mm)	Mandrin L (mm)
Nº de pedido	Tipo	Désignation antérieure	Agujero polar	Mandril de calar D (mm)	Mandril de calar L (mm)

D.C. motors
Moteurs à courant continu
Generadores de corriente continua

0 130 050 . . . to / à / hasta **054 . . .**	–	KM/RC,/RCA, /RCAM,/RCC	35,5 $^{+0,11}_{+0,05}$	35,4 $^{+0,02}_{-0,03}$	60
–	–	KMUE 3 Z . .	33,5 $^{+0,47}_{+0,31}$	33,5 + 0,2	60

All other D.C.motors have field frame as fitted in generators or starters.
Therefore in these cases the driving-in tool listed under starters and generators can be used.

Tous les autres moteurs à courant continu ont la même carcasse polaire que les démarreurs ou les génératrices.
On peut donc dans ces cas utiliser les mandrins cités pour les démarreurs et les génératrices.

Todos los demás motores de corriente continua llevan carcasa polar de generadores o motores de arranque.
Por tanto, en muchos casos pueden utilizarse los mandriles de calar detallados para motores de arranque y generadores.

Kenntnis genommen: Noted by:	Bearbeiter Project Specialist	Inhaber Owner	Meister Supervisor	Mechaniker Mechanic

Notes on Surface Finishing of Collectors on New Motor

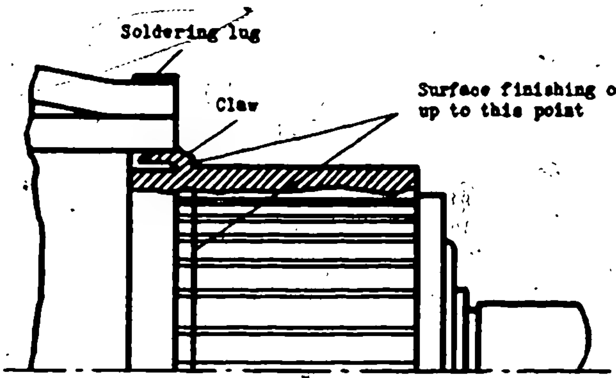
VDT-BME 660/9 B KM
Edition 12.71 13
Translation of German edition of 8.10.1971

To our foreign representatives

For several months, armatures with a new commutator have been installed in various starters (d.c. motors). These are commutators in which each soldering lug for the armature coil ends is held in place by a claw on the commutator segment.

When surfacing commutators of this type of armature, it is essential that surfacing not go beyond the offset already present (see figure) on new (not resurfaced) armatures. Even a few tenths of a milimeter beyond this point can lead to the loosening of the soldering lugs so that the armature becomes defective. Armature failure during operation can damage the entire motor.

Therefore, relieving of commutators is no longer authorized for these armature models.



BOSCH

TEST INSTRUCTIONS

13

VDT-WPE 660/1 B
Ed. 2
supersedes 4.66

D.C. Motors 0 13 . .

C16

C 16

1. Test Equipment and Tools

Generator test bench	EFLJ 20 . .	0 680 110 . .
or	EFLJ 25 . .	0 680 110 . .
Starter test bench	EFAL 30 . .	0 680 100 . .
or	EFAL 90 . .	0 680 100 . .
Swivel vise	KDAW 9999	
(formerly	EFAW 9	0 681 269 007)
Insulation tester	EFAW 90	0 681 169 034
or	EFAW 95	0 681 169 020
Gear wheel	EFMM 1	0 686 318 005
Test panel	EFAW 81	0 681 169 013
Transformer panel	EFAW 82	0 681 169 014
Photoelectric revolution counter e.g.	EFAW 257	0 681 500 800
Driver	EF 3292	1 683 102 004
Belt pulley, adaptor sleeves, round nut for adaptor sleeves, hook wrench (accessory for the generator test bench)		
Spring scale 0 ... 1.2 kgf	KDAW 9991	
(formerly	EF 1244	0 681 400 004)
Spring scale 0 ... 2 kgf	KDAW 9993	
(formerly	EF 1244 B	0 681 400 006)

2. Visual Inspection and General Test

Replace worn out or damaged parts.
Windings must not be burnt out or have become unsoldered.
Detach all ground connections. Test excitation windings and armature for short-circuit to ground.

Test voltage for motors up to 12 V = 40 V~
from 12 to 40 V = 80 V~
over 40 V = 220 V~

Test excitation windings for interturn short-circuit and concentric running.

Maximum runout:

Commutator	0.03 mm/0.0012 in
Laminations	0.05 mm/0.002 in

The brushes must move freely in their holders and must not be dirty, broken or have become unsoldered.
Test brush holders for short-circuit to ground (test voltage as above). Check brush holder fastening.
Ball and roller bearings should have no impressions or corrosion pitting on their running surfaces.
Bearing lubrication according to Lubrication Instructions (Section 5).

3. Mechanical Test

The brush pressure is measured with a spring scale. At the point of contact with the brush, the brush spring is lightly lifted by the spring scale in the direction of the brush axis. The armature should move freely.

Measure longitudinal play of the armature. If different from specified value, this will result in increased bearing wear. The longitudinal play is measured by pushing the armature into the bearings at the commutator or drive end frames. Motors with deep-groove ball bearing bearings have no longitudinal armature play.

C 17
A-1

wPE 66014
Seite 3

4. Electrical Test

4.1 Car heater and blower motors
(0 130 002.. to 0 130 107..)

These motors are loaded with the associated fan and clamped in vise EFAW 9 for testing. A photoelectric revolution counter (e.g. EFAW 257) measures the speed. Other methods of measurement can give a false indication due to loading. Speed and current consumption of the motor are given on the nameplate.

4.2 Fan and lawn mower motors
(0 130 701.. to 0 130 705..)

Fan and lawn mower motors can only be tested when stationary. Remove the armature and use 40 V~ to test for short-circuit to ground. With insulation tester check for interturn short-circuit. To test for open-circuit, connect an ammeter, a 6 or 12 V battery, and a sliding resistor in series. Adjust the resistance so that a current of about 15 A flows in the circuit (Fig. 1a).
Measure the current taken by each two adjacent commutator segments (Fig. 1b).
If the values differ from one another by more than 2 A open-circuit is indicated.
Caution: Make rapid test.

4.3 Testing motors 0 136 . .
(formerly 0 130.. MM/.. or KM/..)

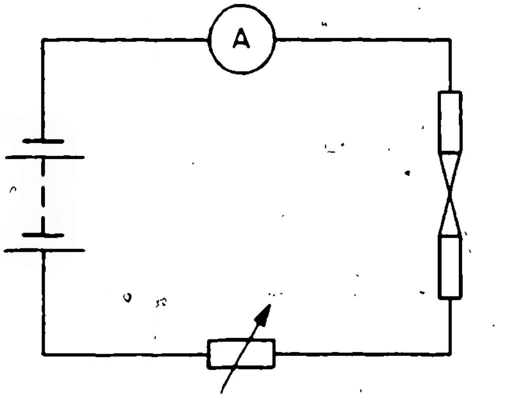
4.3.1 Testing on generator test bench

Leads „B" and „51" on the test bench must be interchanged, so that the measuring range of the ammeter can be fully utilised.

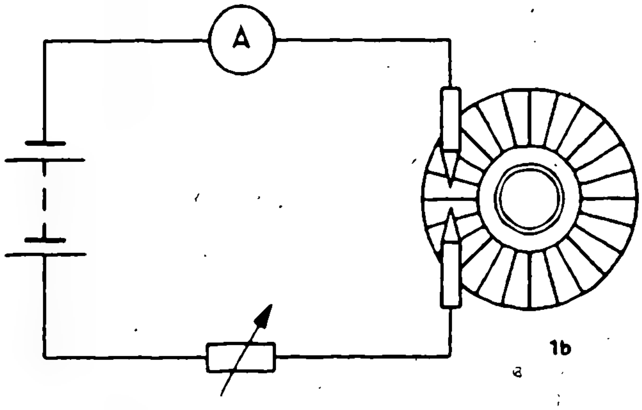
Note:
If the test specifications show that the ammeter of the generator test bench does not suffice for the test, the motor is to be tested on the starter test bench (see section 4.3.2).

Fit belt pulley onto motor shaft with suitable adaptor sleeve (accessory to generator test bench). Fix the motor in the vise prism. Fit and tighten the V-belt. Switch on motor under test and motor on test bench (same direction of rotation). With the handwheel on the test bench regulate the speed until the motor current is as specified. If necessary, make use of the auxiliary braking device. Measure voltage and speed and compare them with the test values.
Carry out idle speed test without V-belt.

The direction of rotation of the motor must agree with the arrow on the housing. With reversible motors check in both directions of rotation.



1a



1b

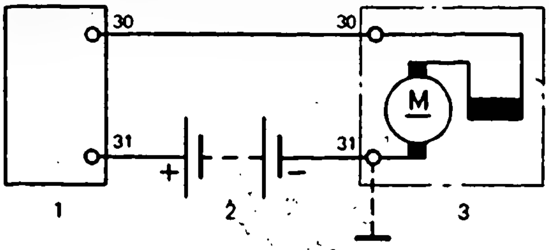
C18

4.3.2 Testing on starter test bench

To test the motors on the starter test bench, fix gear wheel EFMM 1 on the motor shaft. The necessary adaptor sleeves are accessories of generator test benches EFLJ 20.. and 25..
The motor is fixed in the vise prism.
For motors with rated voltage over 24 V additional batteries or cells (see Fig. 2) with a rated capacity of at least 135 Ah must be connected in series.

On starter test bench EFAL 30 C the speed on load can be measured by the built-in electrical revolution counter, when the selector switch is set to "15 teeth" and the reading is doubled.
On starter test bench EFAL 90.. driver EF 3292 is connected to the revolution counter and the speed is measured directly at the armature shaft.
Fix the motor on the test bench so that the ring gear on the test bench (module 2.5) and the gear wheel of the motor engage (backlash 0.3 to 0.6 mm/0.012 to 0.024 in).

Switch on motor, and brake until the specified current consumption is reached. Read off the voltage and speed and compare them with the test specifications. During the idle speed test the gear wheel must not be engaged. With reversible motors test in both directions of rotation.



1 = Test bench batteries
2 = Additional batteries as necessary
3 = Motor under test

5. Lubrication Instructions

Lightly oil exposed parts with Ol 41 v 3 oil. Keep grease and oil from the commutator. Bearings in drive and commutator end frames are greased with Ft 1 v 34.

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50 (4.72)
Printed in Germany
Imprimé en Allemagne Rep. Féd. par Robert Bosch GmbH Hausdruckerei

Water pump

CWB, CRG 0130 997..
(formerly XY/EPB 0444 00..)
XY/EPA 0444 00..

1. GENERAL

The water pumps of type XY/EPA.. and CWB.. (XY/EPB..) serve for cooling water circulation on engines with thermo-siphon cooling and for water supply in trailer caravans. Due to their special design and sealing, these pumps are suitable for vehicles with pressure cooling system having a circulation pressure of up to 1 atm.

These pumps consist of a small electric motor of size C and a centrifugal delivery pump driven directly by the motor shaft. The pump is not self-priming – that is, water must flow to the pump – and must only be operated within the water circulation system. Dry-running is not permissible because this would destroy the seals.

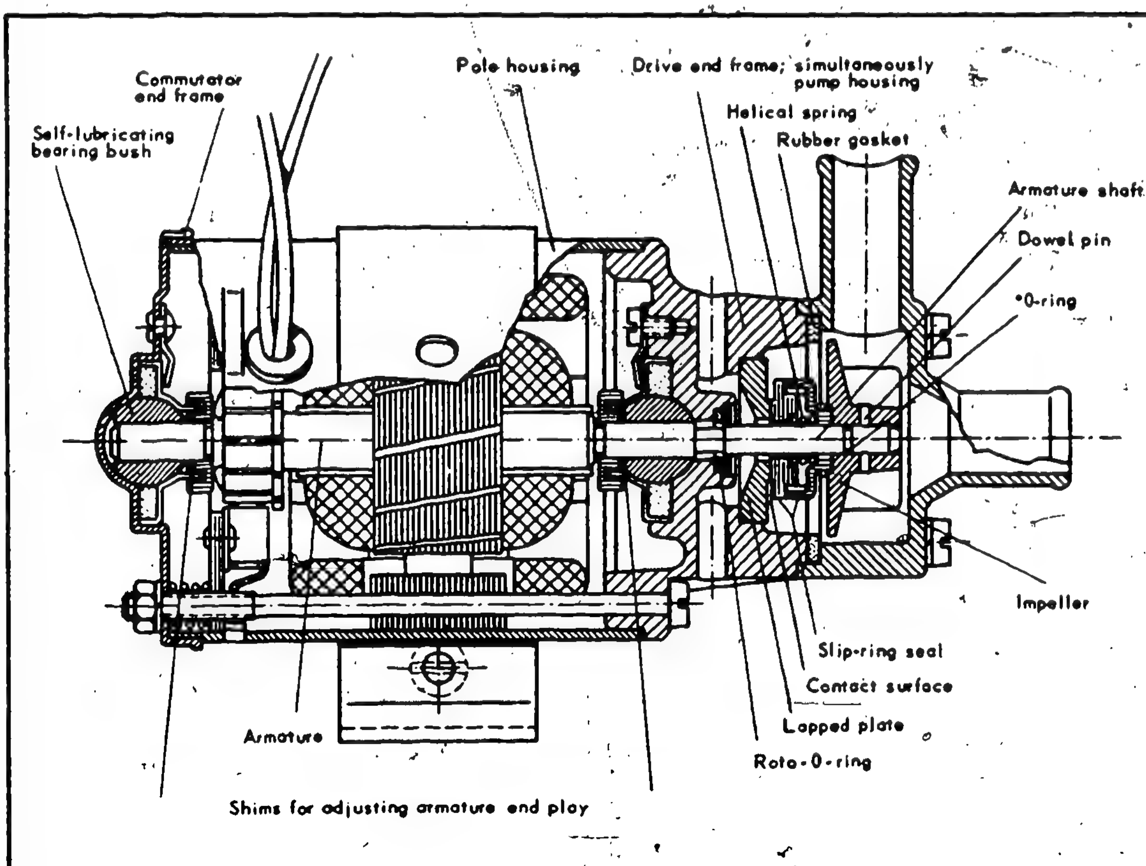


Fig. 1 Design of water pump XY/EPA..

The pump is sealed along the contact surface between a shoulder on the slip-ring seal and the lapped plate. The seal is pressed against the lapped plate by a helical spring.

Any leakage water escapes via the four bores in the drive end frame to the outside and is prevented from entering the motor area by the built-in Roto-0-ring.

2. REPAIRING THE WATER PUMP OF TYPE XY/EPA..

2.1 Dismantling

Unscrew the 4 screws in the front section of the pump; then remove this section from the pump.

Remove sealing compound between impeller and armature shaft with scriber or knife.

The impeller is dowelled to the shaft. Carefully drive out the dowel pin using a 1.5 mm diameter drift or drill out with a 1.5 mm drill bit. Using a suitable extractor, pull off impeller from shaft. The extractor should be applied in such a way that its jaws grab under two impeller blade surfaces.

Remove O-ring from the pump shaft.

Unscrew the two through-bolts holding the bearing shields and pole housing together and remove the rear bearing shield (commutator end frame) from the pole housing. Be careful with the two helical springs and the shims on the armature shaft.

Separate pole housing and front bearing shield (drive end frame).

Pull armature out of the pump housing half against the resistance of the built-in Roto-O-ring.

2.2 Cleaning the components

Remove rust and coarse dirt particles from components (blow out with compressed air). Do not submerge the two bearing shields in solvent for cleaning purposes.

2.3 Inspection, repair and re-assembly

2.3.1 Motor

Here, see appropriate section of test instructions VDT-WPE 660/1 B. Repair is not possible.

The only available spare part is a set of carbon brushes (see VDT-EVE 660/1 B dated 1.65). If the motor has failed, the complete pump XY/EPA.. must be replaced by a new water pump 0 130 997.. (CWB..).

2.3.2 Pump

In the case of pump failure on account of leakages, the slip-ring seal bonded to the impeller must be renewed in each case. The spare parts list VDT-EVE 651/10 B of 2.62 gives under item number 31 "Impeller with sealing ring".

This assembly is now available individually as follows

Impeller	1 146 610 003
Slip-ring seal	1 140 282 000

The above two components must be bonded together in repairing with a contact adhesive (metal-rubber)

Metallogum Kk 67 v 3	5 703 203 000	available in cans
Hardener Ch 104 v 2	5 707 561 510	

To bond the two components, proceed as follows:

Mix 10 parts of adhesive with 1 part of hardener (only mix sufficient quantity for use within 6 to 8 hours, as mixture becomes useless after 8 hours),

Thoroughly degrease the bonding surfaces and roughen smooth rubber surface well.

Coat both bonding surfaces with adhesive.

Pre-dry in room air: 10 to 20 minutes at 20 to 25°C until the adhesive no longer produces "threads" when dabbed.

Glue components together (under short, firm pressure).

Do not subject bonded surfaces to stress for at least 1 hour. Maximum bonding strength only occurs after 24 to 36 hours.

If the original impeller is in good condition, it can be used again. Separate the worn slipring seal from the impeller and carefully remove all adhesive residues from the bonding surface.

In addition, inspect the lapped plate in the end frame for wear and grooves. This plate must be smooth; otherwise, the pump will leak even after fitting a new seal. In such cases, the end frame will have to be renewed.

To ensure that the slipring seal seals efficiently, it must press against the lapped plate of the end frame under a pressure of 1.2 kp.

In this respect, the distance from armature shaft end to the bore for the impeller dowel pin is established as follows:

Measure dimension «a» (Fig. 2).

Compress the slipring seal bonded to the impeller and load with 1.2 kp. In this state, establish the overall dimension «b» (Fig. 3).

Dimension «a» minus «b» gives dimension «c» (Fig. 4).

Dimension «d» is 4.5 mm (Fig. 3).

Dimension «c» and «d» added together give the distance from the shaft end to the centre of the dowel bore at which the seal is pressed against the lapped plate with a pressure of 1.2 kp.

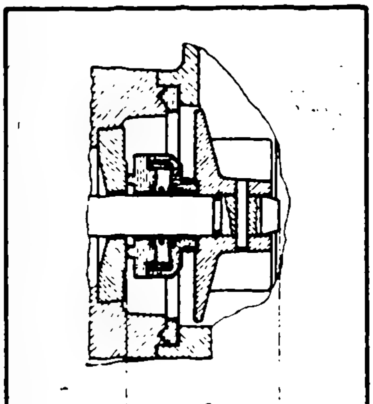


Fig. 2

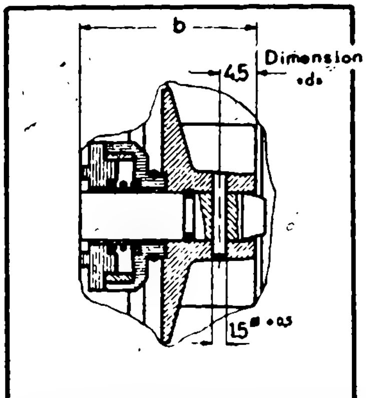


Fig. 3

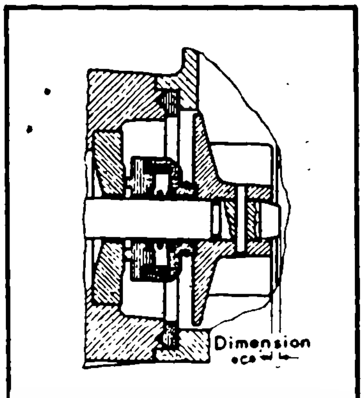


Fig. 4

WJE 65113
Seiks

Assemble armature, pole housing, front and rear bearing shield. Here note:

Carbon brushes must sit on the commutator.

Do not forget the 2 helical springs on the through-bolts for pressing on the current pick-up.

Make sure that the shims have been fitted at both ends of the shaft.

Check armature end play. This should be 0.1...0.2 mm with approx. 1.5 kp pressure applied to the shaft in the direction towards the drive end frame. If necessary, adjust to correct value by inserting shims 1 130 112 005 or ...006.

For final test of motor assembly, see Section 2.4.1.

Drill through the impeller and shaft (armature) offset radially 90° from the original hole using a 1.5 mm drill bit.

Lightly oil slipring seal with Ol 63 v 2-5 701 112... Fit new O-ring 1 440 210 003 into armature shaft groove.

Fit impeller onto shaft and press in with an arbor press until the bores in the impeller and armature are in alignment.

Insert new dowel pin 2 917 016.

Secure shaft and impeller with sealing compound Kk 57 v 1 – 5 703 151 105.

Note: When pressing the slipring seal and impeller onto the shaft, it is essential to ensure that the armature shaft is braced on the commutator side by a suitable support to make certain that the pressure is not taken up by the bearings.

Now screw front section of pump onto drive end frame using new gasket. Tighten screws uniformly and diagonally.

2.4 Testing

2.4.1 Testing the motor assembly
(Carry out test without seal !)

For test procedure, see VDT-WPE 660/1 B.

Test specifications are:

Idling test (test position: vertical, shaft end upward)

Rated motor voltage = Test voltage	6 V	12 V	24 V
Current consumption max.	3.4 A	1.8 A	0.8 A
Minimum speed	3500 R.P.M.	3500 R.P.M.	3500 R.P.M.

▲ Performance test (Test with fan mounted 1 146 613 031 – XYLS 3 Z 1 Z in accordance with VDT-WPE 660/1 B)

Rated motor voltage = Test voltage	6 V	12 V	24 V
Current consumption max.	4.5 A	2.4 A	1.2 A
Minimum speed	2700 R.P.M.	2700 R.P.M.	2700 R.P.M.

Note: The self-lubricating bushes incorporated in the motor are adjustable (see Fig. 4). If the motor does not reach the specified speeds despite higher current consumption, it is possible that the self-lubricating bushes are canted during assembling.

The self-lubricating bearing bushes will set themselves correctly when light blows are applied to the bearing shields using a rubber hammer.

2.4.2 Testing the pump (Leakage test)

Connect pump to test set-up as shown in Fig. 5. The test set-up can be made on site with simple means.

Connect pump to rated voltage. The following test specifications must result:

Pressure head (with valve closed) 0.15 ... 0.25 atm.

The pump should be run in for at least ½ hour and must not lose any water during this time. Prior to putting the pump into operation, it must be bled thoroughly.

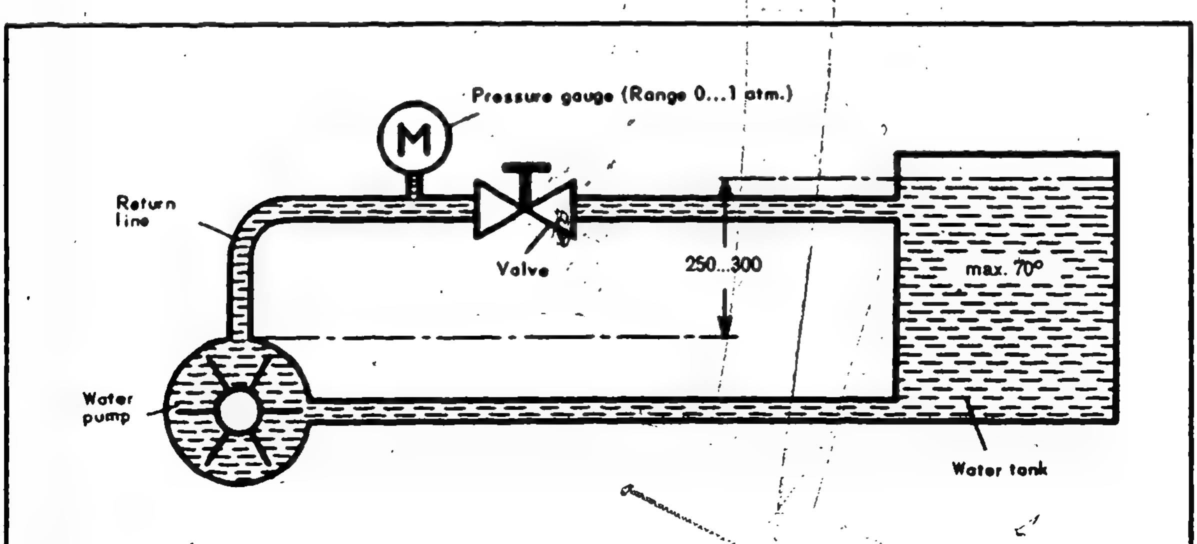


Fig. 5 Water pump leakage test

2.4.3 Testing the delivery rate is not generally necessary because this will be correct when the following prerequisites are met:

The motor achieves its specifications with the electrical test.

The pump showed no leaks during the leakage test and produces the required pressure head.

3. REPAIRING THE WATER PUMP CWB.., CRG.. (formerly XY/EPB..)

The CWB pump differs from the XY/EPA.. type as follows: the motor has its own bearing shield on the pump side; the simplified pump has a housing with projecting edge which fits over the motor housing;
simplified sealing, pressed-on (non-dowelled) impeller.

Therefore, repairing the CWB (XY/EPB) pump is considerably simpler in comparison to the XY/EPA type. The instructions concerning dismantling, cleaning and inspection of the components as well as reassembly as given for the XY/EPA pump analogously apply here also. However, all details concerning bonding and assembly of sealing and pump elements should be eliminated.

The following spare parts are established:

Repair set 1 447 010 000 consisting of:

- 1 dowel pin
- 1 slipring seal, complete with 0-ring, plate and helical spring
- 1 gasket

Repair set 1 447 010 001 consisting of:

- 1 connection adaptor
- 1 pump housing, complete with bonded steel plate
- 2 threaded studs
- 4 lock washers
- 2 slotted nuts

Impeller 1 146 610 005

Motor	for pump		
0 130 056 011	CWB 6 V 5.5 A	—	0 130 997 001
	XY/EPB 1/6/1	—	0 444 004 001
0 130 056 012	CWB 12 V 2.8 A	—	0 130 997 002
	XY/EPB 1/12/1	—	0 444 005 001
0 130 056 013	CWB 24 V 1.4 A	—	0 130 997 003
	XY/EPB 1/24/1	—	0 444 006 001
0 130 059 002 (interference-suppressed)	CWB 24 V 1.4 A	—	0 130 997 004
	XY/EPB 1/24/3	—	0 444 007 001
3 137 220 005 (interference-suppressed for close proximity items)	CRG 24 V 1.4 A	—	0 130 997 005

3.1 The motor test specifications are:

Idling test (Test position: vertical, shaft end upward)

Rated motor voltage = Test voltage	6 V	12 V	24 V
Current consumption max.	3 A	1.5 A	0,8 A
Minimum speed	6700 R.P.M.	6700 R.P.M.	6700 R.P.M.

Performance test (with fan mounted 1 146 613 031 – XYLS 3 Z 1 Z)

Rated motor voltage = Test voltage	6 V	12 V	24 V
Current consumption max.	6.2 A	3.1 A	1.6 A
Minimum speed	3000 R.P.M.	300 R.P.M.	3000 R.P.M.

3.2 Section 2.4.2 applies for pump testing.

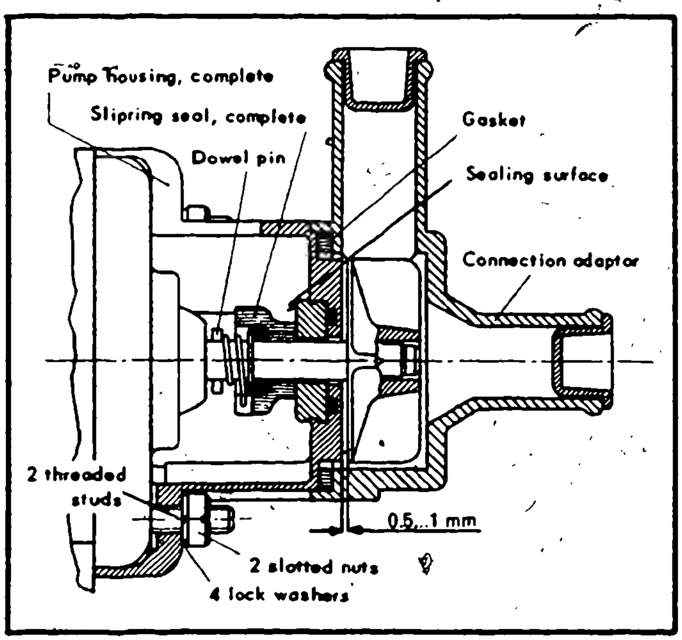


Fig. 6

BOSCH

TEST INSTRUCTIONS

19

VDT-WPE 320/2 B

Ed. 2

~~6.65~~

D.C.-Generator Regulators

C24

C 24

~~A19~~

D.C.-Generator Regulators

Regulator types: Z.., T.., VA, U.., W.. and K..
Explanations of the information given in Test Specification Sheets VDT-WPE 320/2-21 B to 26 B.

Column 1
Bosch Part Number (on the regulator base)

Column 2
Type marking (on the regulator base)
for example: 28 V = generator voltage
10 A = maximum current

Column 3
Regulated Voltage, off load

Test Conditions

Generator correctly matched to regulator for voltage and power.
Generator and regulator cold (approx. +20° C/68° F).
Battery connected across protective resistor. Loading resistor switched off.

Note: Protective resistor current is minimal and not to be considered as load.
Test bench must correspond to latest developments or be modified according to Conversion Instructions VDT-WUF 113/4 B.

Test Bench Connections

Connect generator terminals D+ and D− to the corresponding regulator terminals. Exciter current ammeter between regulator terminal DF and generator terminal DF (ensure correct polarity).
Test bench cable 51 to regulator terminal B+ (51).
Connect voltmeter to regulator terminals D+ and D−. (Ensure correct polarity). Voltmeter minus lead not to terminal screw of the adjustable plate.

Test Procedure

Slowly increase the generator speed until reaching the exciter current peak value (start of regulation); increase speed further until exciter current drops to two-thirds peak value. Regulated voltage, off load is read at this point (on VA regulators within 30 seconds).

Attention

Do not excessively increase the speed of unloaded generators with UE, UF, W and KF regulators (single contact regulators) since this will cause the latter to cease regulating and the voltage will rise above acceptable limits.

Column 4
Regulation Range

Regulator types: Z.., T.., VA and UA to UD (dual-contact regulators).

Note: The regulation range is the difference between the regulated voltage, off load, measured with the regulator contacts at the upper control position and at the lower control position.

Test Conditions

Same as Column 3.

Test Bench Connections

Same as Column 3.

Test Procedure

Read the regulated voltage at the lower control position (see Test Procedure, Column 3). Increase generator speed and read regulated voltage in the upper control position. The voltage usually increases; it may, however, decrease.

Column 5
Regulated Voltage, on load

Column 6
Load Current

Regulator types: Z.., T.., and VA

Test Conditions

Generator correctly matched to regulator for voltage and power.
Generator and regulator cold (approx. +20° C/68° F).
With battery and protective resistor. Loading resistor switched in.

Test Bench Connections

Voltmeter and test bench cable 51 to regulator terminal B+ (51). Switch in loading resistor. Connect test bench battery cable (B+) to the corresponding battery connection terminal.
(Otherwise same as Column 3, "Test Bench Connections".)

Test Procedure

1. Regulators with drooping characteristic curves (Z.. and T..)
Drive the generator at double its rated speed. Set load current (Column 6). At this point, read regulated voltage, on load.

Note: The generator rated speed is the last number of the type marking x 100 for newer generators and is included in the type marking for older generators.

2. Regulators with variode characteristics (VA)
Drive the generator at 5500 rev/min. Switch in battery and the loading resistor and with the loading resistor adjust to the specified load current. Regulated voltage must be read immediately after load current is reached. If the load current is increased too slowly, or the specified current is exceeded, the voltage reading is less than that given in Column 5. The measurement is to be repeated after the resistor has cooled.
The cable set on VA regulators (6 V) which leads to alternator terminal D+ should not be shortened or lengthened since it has been matched to the Variode.

Columns 7 and 8
Current Regulator Cut-In; on load and at double generator speed

Regulator types: U.., W.., and K..

Test Conditions

Without battery, with loading resistor.

Test Bench Connections

Attach voltmeter and loading resistor to regulator terminal B+ (51).

Test Procedure

Drive the generator at about double its rated speed and with the loading resistor increase the load until the voltage suddenly drops. The maximum current must then correspond to the value given in Column 7 or 8.

Column 9
Cutout Relay Cutting-In Voltage

Regulator types: Z.., T.., VA, U.., W.. and K..

Test Conditions

Generator and regulator cold (approx. +20° C/68° F).
Without battery, with loading resistor.

Test Bench Conditions

Voltmeter on regulator terminal D+ (61), test bench cable 51 on regulator terminal B+ (51), without battery, with loading resistor. Otherwise same as Column 3 "Test Bench Connections".

Test Procedure

Set the loading resistor for about two-thirds maximum current. Slowly and uniformly increase the generator speed, causing the voltage to rise. The cutout relay has cut in when the voltage suddenly drops. The cutout relay cutting-in voltage is that voltage reached immediately before the drop. Do not allow the generator to continue running at relay cutting-in speed.

Column 10
Reverse Current

Regulator types: Z.., T.., VA, U.., W.. and K..

Test Conditions

Cold regulator, half-charged battery (switch in loading resistor if battery is fully charged).

Test Bench Connections

Voltmeter and test bench cable 51 to regulator terminal B+ (51), test bench cable B+ on the corresponding battery terminal. Otherwise same as Column 3 "Test Bench Connections".

Test Procedure

Increase the generator speed until the load current stops increasing; then slowly decrease the speed (ammeter pointer moves back across the scale zero point into the battery discharge region) until the cutout relay cuts out at the specified reverse current (value Column 10) and the pointer returns to zero. The voltage read at the instant the relay cuts out should be:

6 V unit	6.1 V
12 V unit	12.2 V
24 V unit	24.4 V

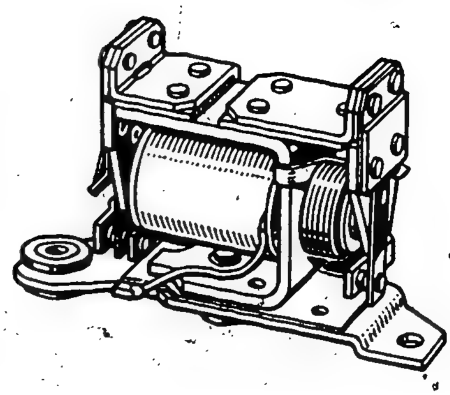
If higher voltages occur, load the battery with the loading resistor.

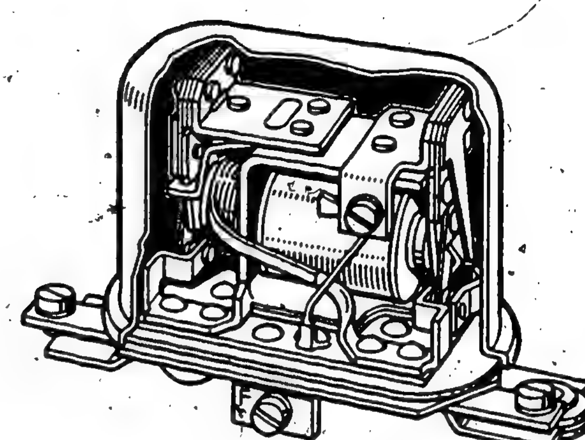
C 26
Atr

Regulator Types

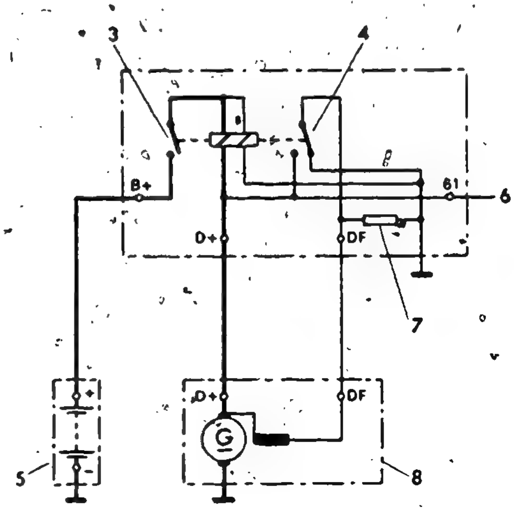
Z regulator

Dual-contact regulator with drooping characteristic curve.
Common magnetic system for voltage regulator and cutout, but separate armatures.
Can be installed as integral or separate-mounted regulator.

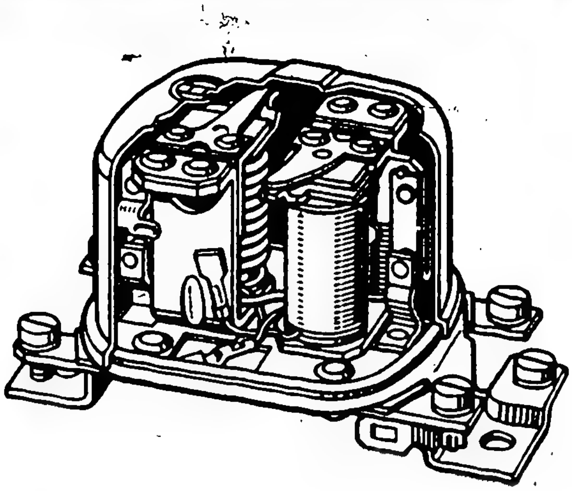




3 = Cutout
4 = Voltage regulator
5 = Battery
6 = to charge indicator
7 = Voltage regulator resistor
8 = Generator



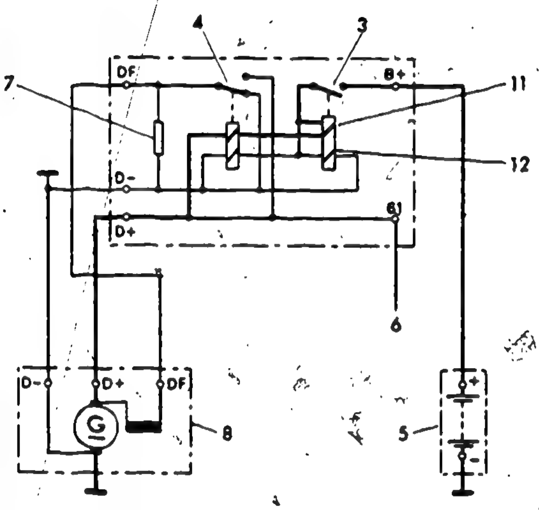
Z regulator circuit diagram



T regulator

Dual-contact regulator with drooping characteristic curve.
Separate magnetic systems for voltage regulator and cutout.
Integral or separate – mounted regulator.

Note:
TB-regulator for generators with + to ground, and end of excitation winding to positive brush.
TC-regulator for generators with + to ground, and end of excitation winding to insulated negative brush.
TD-regulator for generators with – to ground, and end of excitation winding to negative brush.



TA regulator circuit diagram

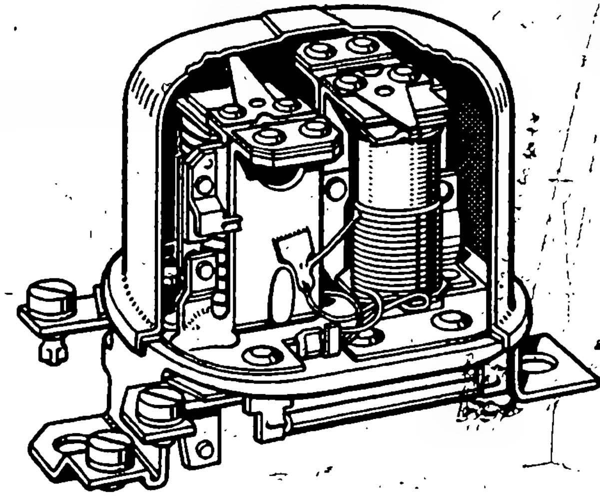
3 = Cutout
4 = Voltage regulator
5 = Battery
6 = to charge indicator
7 = Voltage regulator resistor
8 = Generator
11 = Current winding
12 = Voltage winding

C 28

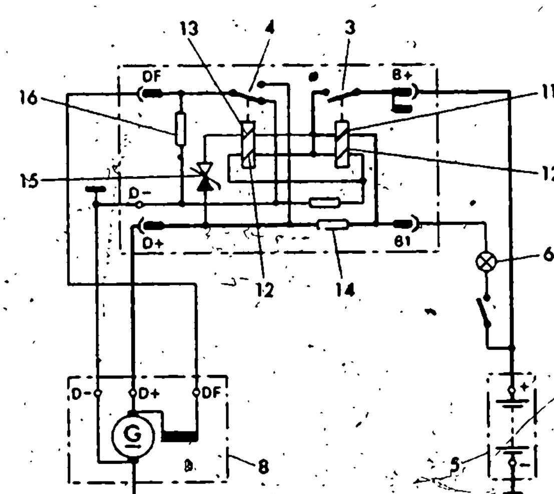
VA regulator.

Variode dual-contact regulator with drooping steep-drop characteristic curve (characteristic curve lies somewhere between that of regulators with drooping and those with steep drop characteristic curves).
Voltage windings in parallel. With Variode and control resistor.

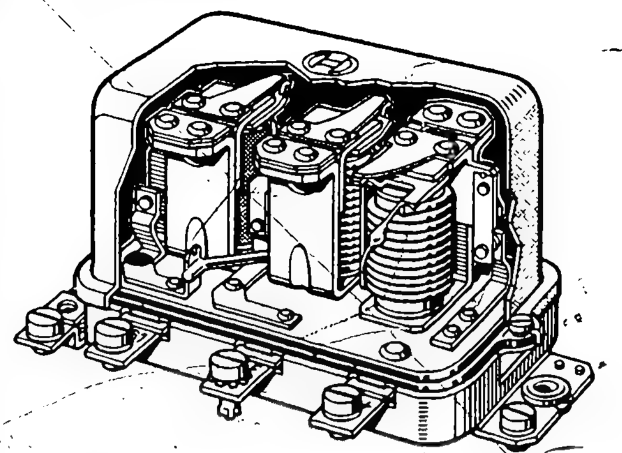
Separate-mounted regulator
The control resistor (control cable) is not be shortened on the 7 V VA regulator.



3 = Cutout
4 = Voltage regulator
5 = Battery
6 = Charge indicator
8 = Generator
11 = Current winding
12 = Voltage winding
13 = Control winding
14 = Control resistor (control cable on 7 V model)
15 = "Variode"
16 = Voltage regulator resistor

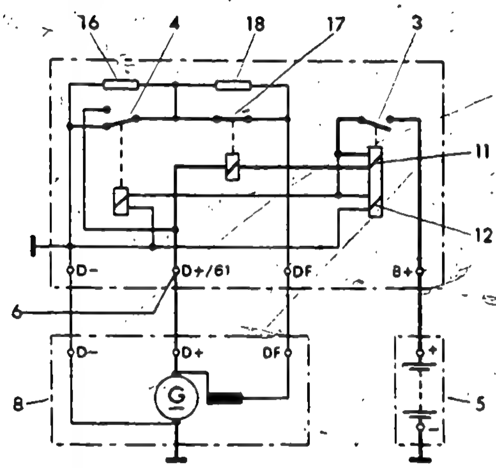


VA regulator (14 V) circuit diagram



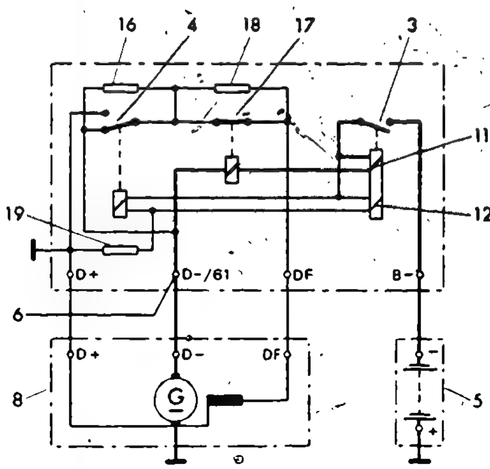
UA to UD regulators

Dual-contact regulator with steep drop characteristic curve.
Separate magnetic systems for voltage regulator, current regulator and cutout.
Separate-mounted regulator.

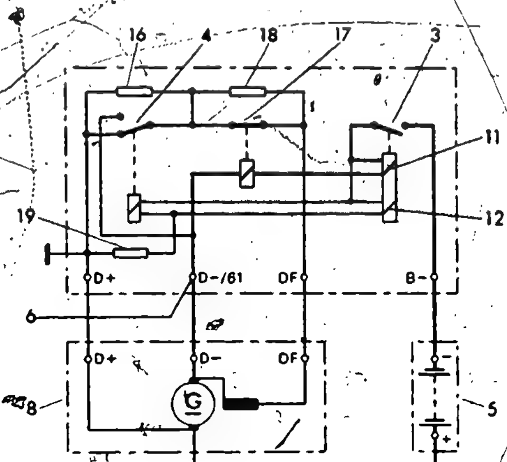


UA regulator circuit diagram

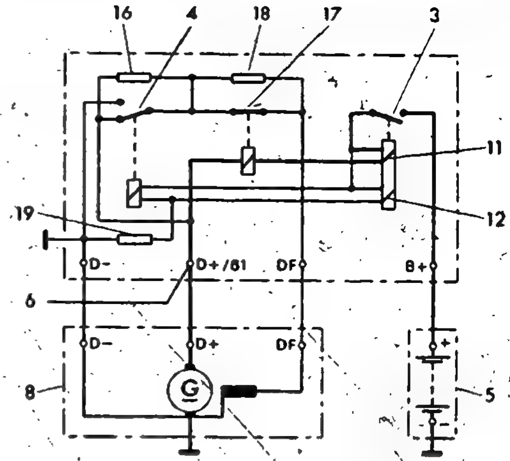
3 = Cutout
4 = Voltage regulator
5 = Battery
6 = to charge indicator
8 = Generator
11 = Current winding
12 = Voltage winding
16 = Voltage regulator resistor
17 = Current regulator
18 = Current regulator resistor
19 = Compensating resistor



UB regulator circuit diagram



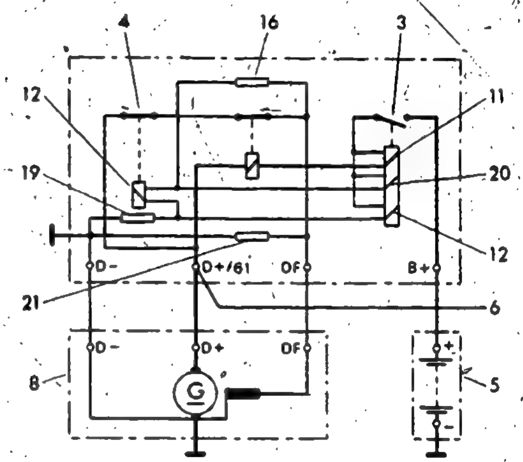
UC regulator circuit diagram



UD regulator circuit diagram

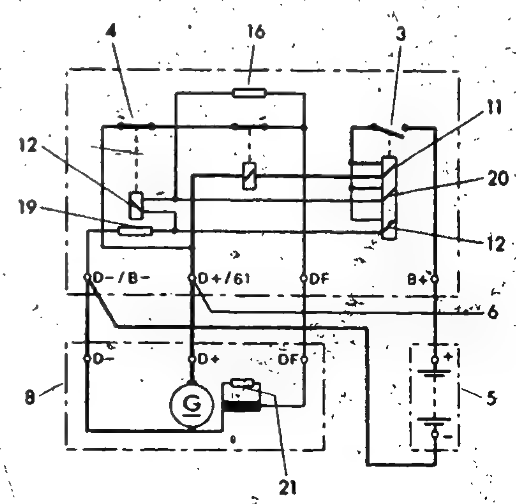
UE, UF regulators

Single-contact regulator with steep-drop characteristic curve.
Separate magnetic systems for voltage regulator, current regulator and cutout.
Separate-mounted regulator.
The connection between D–/B– (regulator) and D– (alternator) must not be broken.

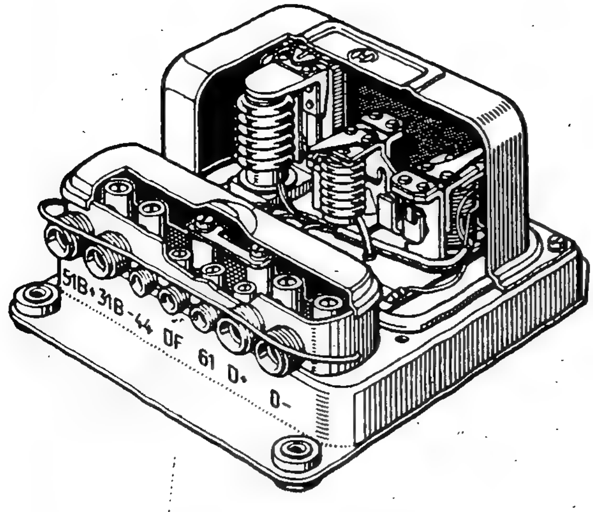


UE regulator circuit diagram

3 = Cutout
4 = Voltage regulator
5 = Battery
6 = to charge indicator
8 = Generator
11 = Current winding
12 = Voltage winding
16 = Voltage regulator resistor
19 = Compensating resistor
20 = Pull-in winding
21 = Damping resistor (only on 37 V regulator)

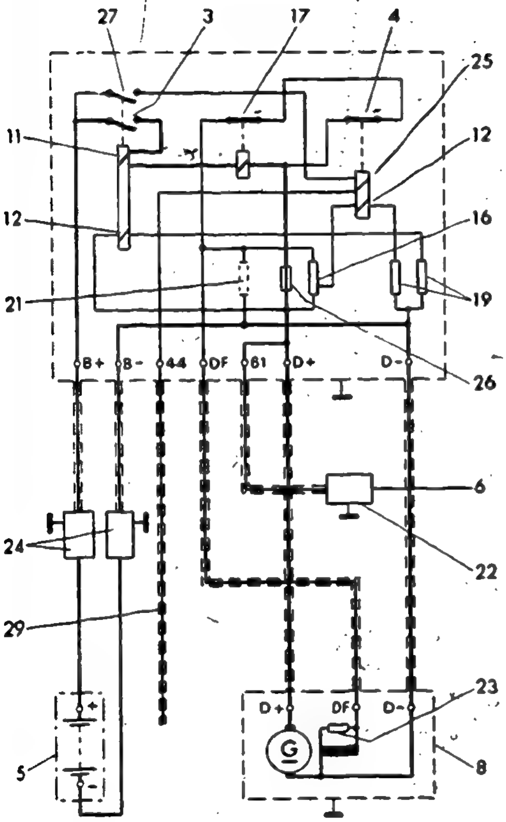


UF regulator circuit diagram



W regulator

Single-contact regulator with steep drop characteristic curve.
Separate magnetic systems for voltage regulator, current regulator and cutout.
Separate-mounted regulator.

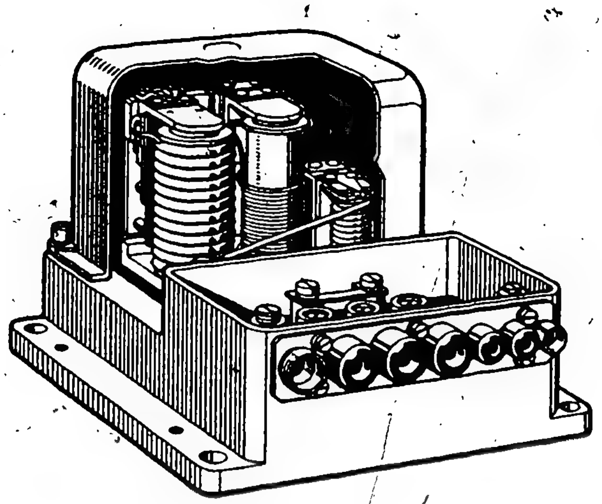


W regulator (28 V and 37 V) circuit diagram

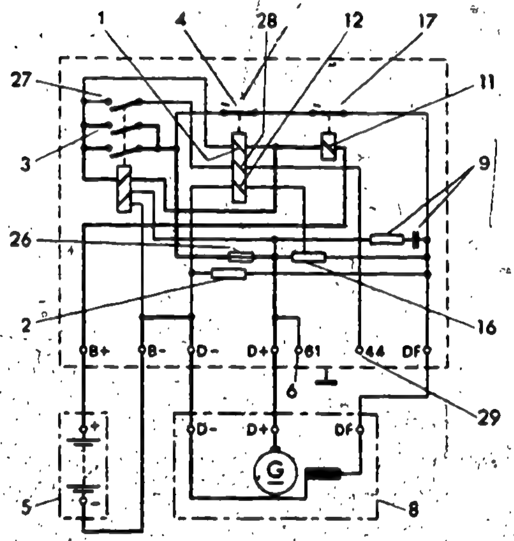
3 = Cutout
4 = Voltage regulator
5 = Battery
6 = to charge indicator
8 = Generator
11 = Current winding
12 = Voltage winding
16 = Voltage regulator resistor
17 = Current regulator
19 = Compensating resistor
21 = Damping resistor (only on 37 V regulator)
22 = Interference suppressor 0 290 003 006
23 = Damping resistor (only on 28 V generators)
24 = Interference suppressor 0 290 003 009
25 = Compensating winding for parallel operation
26 = Fuse
27 = Rest contact
29 = For parallel operation connect to terminal 44 of the 2nd regulator.
For single operation not used.

K regulator

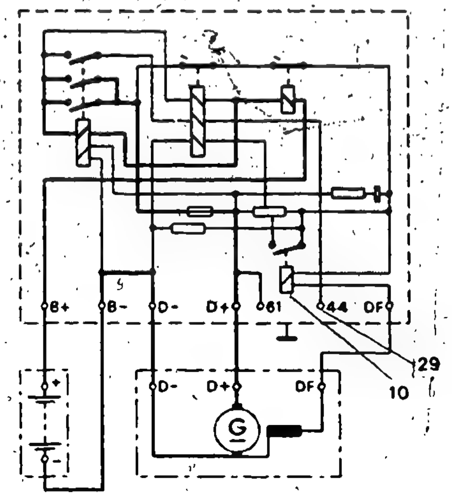
Single-contact regulator with steep drop characteristic curve.
Separate magnetic systems for voltage regulator, current regulator and cutout.
Separate-mounted regulator.



1 = Auxiliary winding (only on 75 and 84 V regulator)
2 = Damping resistance (not on 14 V regulator)
3 = Cutout
4 = Voltage regulator
5 = Battery
6 = to charge indicator
8 = Generator
9 = R–C network for spark-quench (not on 14 V regulator)
10 = Exciter current smoothing relay
11 = Current winding
12 = Voltage winding
16 = Voltage regulator resistor
17 = Current regulator
26 = Fuse
27 = Rest contact
28 = Compensation winding
29 = For parallel operation connect to terminal 44 of the 2nd regulator.
For single operation not used.



K regulator circuit diagram



KF regulator with exciter current smoothing relay
Circuit diagram

1 Part No. 0 190 ..	2 Type	3 Regulator specifications Regulating voltage at no load[1] V	4 Regulation range	5 Regu-lating voltage at load[1] V	6 Load cur-rent A	7 Current regul[…] Load at twice generator spe[…] cold A
102 005	UEM 28 V 10 A	27,1...28,4				9,5...11,5
102 006	UEM 28 V 13 A	27,1...28,4				12 ...14,5
102 007	UEM 28 V 25 A	27,1...28,4				24,5...27
104 039	WF 14 V 38 A	13,5...14,2				34 ...40
104 040	WF 14 V 50 A	13,5...14,2				46 ...52
104 041	WF 14 V 62 A	13,5...14,2				58 ...64
104 042	WF 14 V 75 A	13,5...14,2				71 ...77
104 043	WF 14 V 85 A	13,5...14,2				81 ...87
104 044	WF 28 V 19 A	27,2...28,3				15 ...21
104 045	WF 28 V 19 A	27,2...28,3				15 ...21
104 046	WF 28 V 25 A	27,2...28,3				21 ...27
104 048	WF 28 V 31 A	27,2...28,3				27 ...33
104 049	WF 28 V 38 A	27,2...28,3				34 ...40
104 050	WF 28 V 38 A	29,0...30,0				34 ...40
104 052	WF 28 V 42 A	27,2...28,3				38 ...44
104 053	WF 28 V 42 A	29,0...30,0				38 ...44
104 054	WF 28 V 62 A	27,2...28,3				58 ...64
104 056	WF 28 V 62 A	29,0...30,0				58 ...64
104 058	WF 28 V 81 A	27,2...28,3				77 ...83
104 059	WF 28 V 67 A	27,2...28,3				63 ...69
104 060	WF 28 V 67 A	29,0...30,0				63 ...69
104 061	WF 37 V 47 A	36,6...37,9				43 ...49
104 062	WF 42 V 13 A	41,1...42,4				10 ...13
104 063	WF 28 V 38 A	27,2...28,3				34 ...40
104 064	WF 28 V 19 A	26,8...27,7				15 ...21
104 065	WF 28 V 52 A	27,2...28,3				48 ...54
104 066	WF 14 V 75 A	13,9...14,4				71 ...76

1) Measure at 2/3 max. field current. When resetting and repairing, set to the mean value ± 0.2 V.

3) Test while warm after 30 min. running.

2) Generator speed = the […] (recent models). In the[…] by the type formula.

D6

BOSCH

Generator Regulators
0 190 102 005 to 0 190 116 019

TEST SPECIFICATIONS 19
VDT-WPE 320/2-21 B
Ed. 2
~~12.65~~

7	8	9	10	
Current regulator setting Load at twice rated generator speed[2])		**Specifications for cutout**		Remarks
cold	warm	Cut-in voltage	Reverse current	
A	A	V	A	
9,5...11,5	8,5...10,5	26,9...28,1	2 ... 9	
12 ...14,5	11 ...13,5	26,9...28,1	2 ... 9	
24,5...27	23 ...26	26,9...28,1	2 ... 9	
34 ...40		12,9...13,5	9,5...14,5	
46 ...52		12,9...13,5	9,5...14,5	
58 ...64		12,9...13,5	9,5...14,5	
71 ...77		12,9...13,5	9,5...14,5	
81 ...87		12,9...13,5	9,5...14,5	
15 ...21		26,4...27,1	8,5...13	
15 ...21		26,4...27,1	0,5... 3,5	
21 ...27		26,4...27,1	9,5...14,5	
27 ...33		26,4...27,1	9,5...14,5	
34 ...40		26,4...27,1	9,5...14,5	
34 ...40		27,9...28,6	9,5...14,5	
38 ...44		26,4...27,1	9,5...14,5	
38 ...44		27,9...28,6	9,5...14,5	
58 ...64		26,4...27,1	9,5...14,5	
58 ...64		27,9...28,6	9,5...14,5	
77 ...83		26,4...27,1	9,5...14,5	
63 ...69		26,4...27,1	9,5...14,5	
63 ...69		27,9...28,6	9,5...14,5	
43 ...49		34,9...35,6	3,5... 8,5	
10 ...13		39,4...40,1	2,5... 6,5	
34 ...40		26,4...27,1	1 ... 3	
15 ...21		25,7...26,6	6,5... 7,5	
48 ...54		26,4...27,1	9,5...14,5	
71 ...76		13,1...13,6	7,5...12,5 3)	

...tor speed = the last number of the type designation x 100
... models). In the case of older models, this value is given directly
... type formula.

1 Part No. 0 190 ..	2 Type	3 Regulator specifications Regulating voltage at no load[1]) V	4 Regulation range	5 Regulating voltage at load[1]) V	6 Load current A
112 006	WEM 28 V 38 A	27,2...28,3			
112 010	WEM 28 V 25 A	27,2...28,3			
112 011	WEM 14 V 75 A	13,5...14,3			
112 012	WEM 28 V 38 A	27,2...28,3			
112 013	WEM 28 V 38 A	27,2...28,3			
112 014	WEM 28 V 38 A	27,2...28,3			
113 004	UFM 28 V 19 A	27,1...28,1			
116 001	KF 84 V 27 A	81,9...84,6			
116 002	KF 75 V 31 A	72,9...75,1			
116 003	KF 84 V 21 A	81,9...84,6			
116 004	KF 75 V 23 A	72,9...75,1			
116 005	KF 28 V 62 A	27,1...28,3			
116 006	KF 28 V 54 A	27,1...28,3			
116 007	KF 28 V 62 A	29,6...30,8			
116 008	KF 28 V 83 A	27,1...28,3			
116 009	KF 28 V 83 A	29,6...30,8			
116 011	KF 28 V 67 A	30,6...31,8 27,1...28,3[4])			
116 012	KF 14 V 110 A	13,5...14,4			
116 013	KF 28 V 42 A	27,1...28,3			
116 014	KF 28 V 125 A	27,1...28,3			
116 015	KF 96 V 21 A	93,4...96,6			
116 017	KF 28 V 62 A	27,2...28,3			
116 018	KF 28 V 54 A	27,1...28,3			
116 019	KF 28 V 19 A	27,1...28,3			

1) Measure at 2/3 max. field current. When resetting and repairing, set to the mean value ± 0.2 V.

4) when terminal 63 is grounded.

2) Genera
(recen
by the

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei
(4.71)

D 8

u- g age ad[1])	6 Load current	7 Current regulator setting Load at twice rated generator speed[2]) cold	8 warm	9 Specifications for cutout Cut-in voltage	10 Reverse current	Remarks
	A	A	A	V	A	
		34 ... 40		26,4...27,1	9,5...14	
		21 ... 27		26,4...27,3	9,5...14,5	
		71 ... 77		12,9...13,4	9,5...14	
		34 ... 40		26,4...27,1	9,5...14	
		34 ... 40		26,4...27,1	9,5...14,	
		34 ... 40		26,4...27,1	9,5...14	
		18,5... 21	17,5...20	26,9...28,1	2 ... 9	
		23 ... 27,5		78,9...81,1	4,5... 8,5	
		27 ... 33		69,9...71,1	4,5... 8,5	
		17 ... 23		78,9...81,1	4,5... 8,5	
		19 ... 25		69,9...71,1	4,5... 8,5	
		58 ... 64		26,4...27,1	8,5...13,5	
		50 ... 56		26,4...27,1	8,5...13,5	
		58 ... 64		28,9...29,5	8,5...13,5	
		79 ... 85		26,4...27,1	8,5...13,5	
		79 ... 85		28,9...29,6	8,5...13,5	
		63 ... 69		26,4...27,1	8,5...13,5	
		105 ...112		12,9...13,5	8,5...13,5	
		38 ... 44		26,4...27,1	2,5... 5,5	
		119,5...127,5		26,4...27,1	8,5...13,5	
		18,5... 22,5		90,9...92,1	4,5... 8,5	
		60 ... 62		26,4...27,1	9 ...13	
		50 ... 56		26,4...27,1	8,5...13,5	Field relay
		15 ... 21		26,4...27,1	7,5...14,5	

Field relay

with	without
adjusting screw	
1.8 ... 2.0 A	1.6 ... 1.8 A
cut-in current	
1.2 ... 1.4 A	0.8 ... 1.2 A
cut-out current	

2) Generator speed = the last number of the type designation x 100 (recent models). In the case of older models, this value is given directly by the type formula.

D 9

1 Part No. 0 190 ..	2 Type	3 Regulating voltage at no load[1]) V	4 Regulation range	5 Regu-lating voltage at load V	6 Load cur-rent A	7 Current regul… Load at twic… generator spe… cold A
		Regulator specifications				
117 001	UE 28 V 6 A	27,1...28,4				5 ... 7
117 002	UE 28 V 10 A	27,1...28,4				9,5...11,5
117 003	UE 28 V 13 A	27,1...28,4				12 ...14,5
117 004	UE 28 V 19 A	27,1...28,4				18 ...21,5
117 006	UE 28 V 13 A	27,1...28,4				12,5...15
117 007	UE 28 V 25 A	27,1...28,4				24 ...27,5
117 008	UE 28 V 10 A	27,1...28,4				9,5...11,5
117 009	UE 28 V 19 A	27,1...28,4				18 ...21,5
117 011	UE 28 V 18 A	27,1...28,4				17 ...19,5
118 001	UF 28 V 8 A	27,1...28,4				7,5... 9,5
118 002	UF 28 V 10 A	27,1...28,4				9,5...11,5
118 003	UF 28 V 13 A	27,1...28,4				12 ...14,5
118 005	UF 28 V 19 A	27,1...28,4				18,5...21
118 006	UF 28 V 15 A	27,1...28,4				12,5...15
118 007[3])	UF 28 V 29 A	12,2...13,2				30 ...32
118 008[3])	UF 28 V 17 A	12,2...13,2				15 ...17,5
118 009	UF 28 V 13 A	27,1...28,4				12,5...14,5

Note: Voltage regulators UE and UF have a "draw-in" coil; the values in columns 3 and 9 may therefore overlap.

1) Measure at 2/3 max. field current. When resetting and repairing, set to the mean value ±0.2 V.

2) Generator speed = the last number of the type designation × 100 (recent models). In the case of older models, this value is given directly by the type formula.

3) Use EJMG charging un…
grounded. Column 3, …
disconnecting from 2/3…
0 190 118 007 = 3 600…
0 190 118 008 = 3 000…

D10
Seite 1

BOSCH

Generator Regulators
0 190 117 001 to 0 190 213 016

	8	9	10	
…rent regulator cut-in …d at twice rated …erator speed[2])		**Cutout specifications**		Remarks
		Cut-in voltage	Reverse current	
…d	warm			
	A	V	A	
… 7	4 … 6	26,9…28,1	2 …9	
5…11,5	8,5…10,5	26,9…28,1	2 …9	
…14,5	11 …13,5	26,9…28,1	2 …9	
…21,5	17 …20,5	26,9…28,1	2 …9	
5…15	11,5…14	26,9…28,1	2 …9	
…27,5	23 …26,5	26,9…28,1	2 …9	
5…11,5	8,5…10,5	26,9…28,1	2 …9	
…21,5	17 …20,5	26,9…28,1	2 …9	
…19,5	16 …18,5	26,9…28,1	2 …9	
5… 9,5	6,5… 8,5	26,9…28,1	2 …9	
5…11,5	8,5…10,5	26,9…28,1	2 …9	
		26,9…28,1		
…14,5	11 …13,5	26,9…28,1	2 …9	
5…21	17,5…20	26,9…28,1	2 …9	
5…15	11,5…14	26,9…28,1	2 …9	
…32	30 …32	11,9…12,6	4 …9,5	
…17,5	14 …16,5	11,9…12,6	1,5…7	
5…14,5	11 …13,5	26,9…28,1	2 …7,5	

…charging unit only with proper switching box; terminal 63
…Column 3, measure regulating voltage after connecting and
…ng from 2/3 J max. Generator speed for
…007 = 3 600 rev/min
…008 = 3 000 rev/min

TEST SPECIFICATIONS 19
VDT-WPE 320/2-22 B
Ed. 3

D 11
Seite 86

1 Part No. 0 190 ..	2 Type	3 Regulating voltage at no load[1]) V	4 Regulation range
		Regulator specificatio	
205 001	ZAA 7 V 19 A	7,2... 7,9	−0,1... +0,3
205 002	ZAA 7 V 15 A	7,2... 7,9	−0,1... +0,3
205 004	ZAA 7 V 19 A	7,0... 7,7	−0,1... +0,3
205 005	ZAA 14 V 9 A	13,8...14,8	−0,1... +0,4
206 004	ZAB 7 V 15 A	7,0... 7,7	−0,1... +0,3
206 005	ZAB 7 V 9 A	6,7... 7,4	−0,1... +0,3
206 008	ZAB 7 V 15 A	6,9... 7,8	−0,1... +0,3
206 010	ZAB 14 V 11 A	13,9...15,0	−0,1... +0,4
206 011	ZAB 14 V 11 A	13,9...15,0	−0,1... +0,4
206 013	ZAB 7 V 15 A	6,8... 7,5	−0,1... +0,3
206 015	ZAB 14 V 12 A	13,9...15,0	−0,1... +0,4
206 016	ZAB 14 V 12 A	13,5...14,5	−0,1... +0,4
207 003	ZAC 14 V 9 A	13,9...15,0	−0,1... +0,4
213 001	TA 7 V 40 A	7,3... 8,0	−0,05... +0,3
213 003	TA 7 V 23 A	7,3... 8,0	−0,05... +0,3
213 004	TA 14 V 11 A	14,0...15,1	−0,1... +0,4
213 005	TA 14 V 11 A	14,0...15,1	−0,1... +0,4
213 007	TA 7 V 33 A	7,3... 8,0	−0,1... +0,3
213 009	TA 14 V 16 A	14,0...15,1	−0,1... +0,4
213 010	TA 7 V 33 A	7,3... 8,0	−0,1... +0,3
213 011	TA 14 V 16 A	14,0...15,1	−0,1... +0,4
213 013	TA 7 V 45 A	7,4... 8,1	−0,1... +0,3
213 014	TA 14 V 16 A	14,0...15,1	−0,1... +0,4
213 015	TA 7 V 45 A	7,4... 8,1	−0,1... +0,3
213 016	TA 14 V 11 A	14,0...15,1	−0,1... +0,4

[1]) Measure at 2/3 max. field current. When resetting and repairing, se the mean value ± 0.2 V.

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei
(3.73)

~~Seite 3~~ D12

	5	6	7	8	9	10	
…pecifications		Load current	Current regulator cut-in Load at twice rated generator speed[2])		Cutout specifications		Remarks
…ation	Regulating voltage at load		cold	warm	Cut-in voltage	Reverse current	
	V	A	A	A	V	A	
… +0,3	6,5… 7,4	11,5			6,4… 7,1	2,5… 9	
… +0,3	6,5… 7,4	11,5			6,4… 7,1	2,5… 9	
… +0,3	6,1… 7,0	13,5			6,1… 6,8	2,5… 9	
… +0,4	13,1…14,3	7			12,2…13,4	2,5… 9	
… +0,3	6,3… 7,2	11,5			6,4… 7,1	2,5… 9	
… +0,3	6,3… 7,2	6,5			6,0… 6,7	2,5… 9	
… +0,3	6,2… 7,3	11,5			6,4… 7,1	2,5… 9	
… +0,4	13,3…14,5	8,5			12,9…13,7	6 …12	
… +0,4	13,3…14,5	8,5			12,9…13,7	6 …12	
… +0,3	6,1… 7,0	11			6,2… 6,9	2,5… 9	
… +0,4	13,0…14,0	8,5			12,9…13,7	4,5… 9,5	
… +0,4	12,6…13,6	8,5			12,7…13,4	4,5… 9,5	
… +0,4	13,5…14,7	6			12,9…13,7	6 …12	
… +0,3	6,4… 7,3	31			6,2… 6,8	2 … 5,5	
… +0,3	6,6… 7,5	17,5			6,2… 6,8	2 … 7,5	
… +0,4	12,8…14,1	8,5			12,6…13,4	2 … 7,5	
… +0,4	12,8…14,1	8,5			12,6…13,4	2 … 7,5	
… +0,3	6,6… 7,5	25			6,2… 6,8	2 … 7,5	
… +0,4	12,9…14,2	12			12,6…13,4	2 … 7,5	
… +0,3	6,6… 7,5	25			6,2… 6,8	2 … 5,5	
… +0,4	12,9…14,2	12			12,6…13,4	2 … 7,5	
… +0,3	6,4… 7,3	34			6,2… 6,8	2 … 5,5	
… +0,4	12,9…14,2	12			12,6…13,4	2 … 7,5	
… +0,3	6,4… 7,3	34			6,2… 6,8	2 … 5,5	
… +0,4	12,8…14,1	8,5			12,6…13,4	2 … 7,5	

…pairing, set to

[2]) Generator speed = the last number of the type designation x 100 (recent models). In the case of older models, this value is given directly by the type formula.

D 13

1 Part No. 0 190 ..	2 Type	3 Regulator specifications Regulating voltage at no load[1]) V	4 Regulation range	5 Regulating voltage at load V	6 Load current A	7 Current regul… Load at twice generator spe… cold A
213 017	TA 14 V 16 A	13,7...14,8	–0,1... +0,4	12,6...13,9	12	
213 019	TA 14 V 20 A	14,2...15,3	–0,1... +0,4	13,0...14,3	15	
213 020	TA 7 V 23 A	7,3... 8,0	0... +0,4	6,6... 7,5	17,5	
213 031	TA 7 V 45 A	7,4... 8,1	–0,1... +0,3	6,4... 7,3	34	
213 032	TA 7 V 45 A	7,4... 8,1	–0,1... +0,3	6,4... 7,3	34	
213 033	TA 14 V 20 A	14,2...15,3	–0,1... +0,4	13,0...14,3	16	
213 034	TA 7 V 23 A	7,3... 8,0	0... +0,4	6,6... 7,5	19	
213 036	TA 7 V 45 A	7,4... 8,1	–0,1... +0,3	6,4... 7,3	34	
213 037	TA 7 V 45 A	7,4... 8,1	–0,1... +0,3	6,4... 7,3	34	
215 001	TA 7 V 40 A	7,1... 7,8	–0,1... +0,3	6,3... 7,2	30	
215 003	TA 14 V 20 A	14,3...15,3	–0,1... +0,4	13,1...14,3	15	
215 004	TA 14 V 16 A	13,8...14,9	–0,1... +0,4	12,7...14,0	12	
215 005	TA 14 V 16 A	13,8...14,9	–0,1... +0,4	12,7...14,0	12	
215 006	TA 7 V 23 A	7,0... 7,7	–0,1... +0,3	6,3... 7,2	17	
215 011	TA 7 V 45 A	7,3... 8,0	–0,1... +0,3	6,3... 7,2	34	
215 013	TA 7 V 45 A	7,3... 8,0	–0,1... +0,3	6,3... 7,2	34	
215 014	TA 14 V 11 A	13,8...14,9	–0,1... +0,4	12,6...13,9	8	
215 015	TA 14 V 11 A	13,8...14,9	–0,1... +0,4	12,6...13,9	8	
215 016	TA 14 V 11 A	13,6...14,7	–0,1... +0,4	12,4...13,7	8	
215 021	TA 7 V 45 A	7,3... 8,0	–0,1... +0,3	6,3... 7,2	34	
215 025	TA 7 V 45 A	7,3... 8,0	–0,1... +0,4	6,3... 7,2	34	
215 027	TA 14 V 11 A	13,8...14,9	–0,1... +0,4	12,6...13,9	8	
215 028	TA 14 V 11 A	13,6...14,7	–0,2... +0,2	12,6...13,9	8	
215 029	TA 14 V 11 A	13,4...14,5	–0,2... +0,2	12,2...13,5	8	

1) Measure at 2/3 max. field current. When resetting and repairing, set to the mean value ± 0.2 V.

2) Generator speed = the… (recent models). In th… by the type formula.

D14
Seite 2

	8	9	10	
rrent regulator cut-in oad at twice rated nerator speed[2])		Cutout specifications		Remarks
ld	warm	Cut-in voltage	Reverse current	
	A	V	A	
		12,6...13,4	2...7,5	
		12,6...13,4	2...7,5	
		6,2... 6,8	2...7,5	
		6,2... 6,8	2...5,5	
		6,2... 6,8	2...5,5	
		12,6...13,4	2...7,5	
		6,2... 6,8	2...7,5	
		6,2... 6,8	2...5,5	
		6,2... 6,8	2...5,5	
		5,6... 6,6	2...7,5	
		12,4...13,1	2...7,5	
		12,4...13,1	2...7,5	
		12,4...13,1	2...7,5	
		5,9... 6,6	2...7,5	
		6,2... 6,8	2...7,5	
		6,2... 6,8	2...7,5	
		12,4...13,1	2...7,5	
		12,4...13,1	2...7,5	
		12,4...13,1	2...7,5	
		6,2... 6,8	2...7,5	
		6,2... 6,8	2,5...6,5	
		12,4...13,1	2...7,5	
		12,4...13,1	2...7,5	
		12,2...12,9	2...7,5	

r speed = the last number of the type designation x 100
nodels). In the case of older models, this value is given directly
pe formula.

BOSCH

Generator Regulators
0 190 213 017 to 0 190 301 020

TEST SPECIFICATIONS
19
VDT-WPE 320/2-23 B
Ed. 3

D 15
Seitz

1	2	3	4	5
Part No.	Type	Regulator specifications		
		Regulating voltage at no load[1]	Regulation range	Regulating voltage at load
0 190 ..		V		V
215 030	TA 14 V 16 A	13,8...14,9	–0,1... +0,4	12,7...14,0
215 031	TA 14 V 16 A	13,8...14,9	–0,1... +0,4	12,7...14,0
215 032	TA 7 V 45 A	7,3... 8,0	–0,1... +0,3	6,3... 7,2
215 034	TA 14 V 25 A	13,8...14,9	–0,1... +0,4	12,4...13,7
217 001	TD 14 V 19 A	13,8...14,9	–0,1... +0,4	12,4...13,7
217 002	TD 14 V 25 A	13,8...14,9	–0,1... +0,4	12,4...13,7
217 003	TD 7 V 33 A	7,4... 8,1	–0,1... +0,3	6,7... 7,6
217 004	TD 14 V 20 A	14,1...15,2	–0,1... +0,4	12,9...14,2
217 005	TD 7 V 33 A	7,0... 7,7	–0,1... +0,3	6,3... 7,2
217 012	TD 14 V 11 A	13,8...14,9	–0,1... +0,5	12,6...13,9
218 001	TB 14 V 11 A	13,8...14,9	–0,1... +0,4	12,6...13,9
218 002	TB 14 V 16 A	13,8...14,9	–0,1... +0,4	12,7...14,0
218 003	TB 14 V 20 A	14,1...15,2	–0,1... +0,4	12,9...14,2
218 004	TB 14 V 25 A	13,8...14,9	–0,1... +0,4	12,4...13,7
219 001	ZAD 14 V 11 A	13,5...14,5	–0,1... +0,4	12,9...14,1
219 002	ZAD 14 V 20 A	13,8...14,8	–0,1... +0,4	13 ...14,2
219 003	ZAD 14 V 16 A	14,4...15,4	–0,1... +0,4	13,6...14,9
219 004	ZAD 14 V 16 A	13,9...15,0	–0,1... +0,4	13,3...14,5
219 005	ZAD 14 V 16 A	14,4...15,4	–0,1... +0,4	13,6...14,9
222 001	TC 14 V 20 A	14,3...15,3	–0,1... +0,4	13,1...14,3
300 093	UA 7 V 50 A	7,1... 7,8	–0,1... +0,2	
301 015	UAM 14 V 31 A	13,9...14,2	–0,2... +0,2	
301 016	UAM 14 V 38 A	13,7...14,7	–0,2... +0,2	
301 020	UAM 7 V 40 A	6,9... 7,6	–0,1... +0,2	

1) Measure at 2/3 max. field current. When resetting and repairing, set to the mean value ± 0.2 V.

3) Test while warm after 30 min. running.

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckere
(3.73)

D 16

...ns regu- lating voltage at load	6 Load cur- rent A	7 Current regulator cut-in Load at twice rated generator speed²) cold A	8 warm A	9 Cutout specifications Cut-in voltage V	10 Reverse current A	Remarks
2,7...14,0	12			12,4...13,1	2 ... 7,5	
2,7...14,0	12			12,4...13,1	2 ... 7,5	
6,3... 7,2	34			6,2... 6,8	2 ... 7,5	
2,4...13,7	27			12,4...13,1	2 ... 7,5	
2,4...13,7	12			12,9...13,6	2 ... 7,5	
2,4...13,7	27			12,4...13,1	2 ... 7,5	
6,7... 7,6	26			6,2... 6,8	2 ... 7,5	
2,9...14,2	15			12,4...13,1	2 ... 7,5	
6,3... 7,2	24,5			5,9... 6,6	2 ... 7,5	
2,6...13,9	8,5			12,4...13,1	2 ... 7,5	
2,6...13,9	8			12,4...13,1	2 ... 7,5	
2,7...14,0	12			12,4...13,1	2. ... 7,5	
2,9...14,2	15			12,4...13,1	2 ... 7,5	
2,4...13,7	27			12,4...13,1	2 ... 7,5	
2,9...14,1	8,5			12,6...13,4	6 ...12	
...14,2	15			12,9...13,7	6 ...12	with starting relay
3,6...14,9	13			12,9...13,7	6 ...12	Cut-in voltage 3.5 ... 4.5 V
3,3...14,5	8,5			12,9...13,7	6 ...12	Opening voltage 1.5 ... 2.5 V
3,6...14,9	13			12,9...13,7	6 ...12	
3,1...14,3	15			12,4...13,1	2 ... 7,5	
		50...54	47...51	6,2... 6,8	2,5... 8	
		29...31	29...31	13,1...13,4	4 ... 8³)	
		38...42	35...39	12,6...13,5	5,5...11	
		39...43	37...42	6,0... 6,6	5 ...11	

2) Generator speed = the last number of the type designation x 100 (recent models). In the case of older models, this value is given directly by the type formula.

D 17
Seite 4

1 Part No. 0 190 ..	2 Type	3 Regulator specifications Regulating voltage at no load[1]) V	4 Regulation range	5 Regu-lating voltage at load V	6 Load cur-rent A	7 Current regul Load at twice generator spe cold A
301 021	UAM 7 V 50 A	6,9... 7,6	–0,1... +0,2			49 ...53
301 022	UAM 14 V 11 A	13,5...14,5	–0,3... +0,2			10,5...13
301 023	UAM 14 V 20 A	13,5...14,5	–0,3... +0,2			19 ...23
301 024	UAM 14 V 25 A	13,5...14,5	–0,3... +0,2			24 ...28
301 026	UAM 14 V 38 A	13,5...14,5	–0,3... +0,2			37 ...41
309 001	UA 7 V 40 A	6,9... 7,6	–0,1... +0,3			39 ...43
309 002	UA 14 V 30 A	13,5...14,5	–0,2... +0,2			29 ...33
309 003	UA 14 V 16 A	13,5...14,5	–0,3... +0,2			15 ...19
309 004	UA 14 V 20 A	13,5...14,5	–0,3... +0,2			19 ...23
309 005	UA 14 V 38 A	13,5...14,5	–0,3... +0,2			37 ...41
309 007	UA 14 V 38 A	13,5...14,5	–0,3... +0,2			37 ...41
309 009	UA 14 V 30 A	13,5...14,5	–0,3... +0,2			29 ...33
309 010	UA 14 V 38 A	13,5...14,5	–0,3... +0,2			37 ...41
309 012	UA 14 V 16 A	13,5...14,5	–0,3... +0,2			15 ...19
309 014	UA 7 V 23 A	6,9... 7,6	–0,1... +0,3			22 ...26
309 015	UA 14 V 16 A	13,5...14,5	–0,3... +0,2			15 ...19
309 016	UA 14 V 20 A	13,5...14,5	–0,3... +0,2			19 ...23
309 017	UA 7 V 50 A	6,9... 7,6	–0,1... +0,3			49 ...53
309 018	UA 14 V 25 A	13,5...14,5	–0,3... +0,2			24 ...28
309 019	UA 14 V 30 A	13,9...14,9	–0,3... +0,2			30 ...34

1) Measure at 2/3 max. field current. When resetting and repairing, set to the mean value ± 0.2 V.

2) Generator speed = the (recent models). In th by the type formula.

D 18

Seite 1

BOSCH

Generator Regulators
0 190 301 021 to 0 190 310 004

TEST SPECIFICATIONS
19
VDT-WPE 320/2-24 B
Ed. 3

7	8	9	10	
urrent regulator cut-in oad at twice rated enerator speed[2])		Cutout specifications		Remarks
		Cut-in voltage	Reverse current	
old	warm			
	A	V	A	
9 ...53	47,5...52,5	6,0... 6,6	5 ...11,5	
0,5...13	9 ...12	12,5...13,2	2,5... 8	
9 ...23	17,5...22	12,5...13,2	5 ...11,5	
4 ...28	22,5...27	12,5...13,2	5 ...11,5	
7 ...41	35,5...40	12,5...13,2	5 ...11,5	
9 ...43	37 ...42	6,0... 6,6	5 ...11,5	
9 ...33	27,5...32	12,5...13,2	5 ...11,5	
5 ...19	14 ...18	12,5...13,2	5 ...11,5	
9 ...23	17,5...22	12,5...13,2	5 ...11,5	
7 ...41	35,5...40	12,5...13,2	5 ...11,5	
7 ...41	35,5...40	12,5...13,2	5 ...11,5	
9 ...33	27,5...32	12,5...13,2	7 ...12	
7 ...41	35,5...40	12,5...13,2	7 ...12	
5 ...19	14 ...18	12,5...13,2	5 ...11,5	
2 ...26	21,5...25,5	6,0... 6,6	5......11,5	
5 ...19	14 ...18	12,5...13,2	5 ...11,5	
9 ...23	17,5...22	12,5...13,2	5 ...11,5	
9 ...53	47,5...52,5	6,0... 6,6	5 ...11,5	
4 ...28	22,5...27	12,5...13,2	5 ...11,5	
0 ...34	29 ...33	12,5...13,2	5 ...11,5	

r speed = the last number of the type designation x 100
odels). In the case of older models, this value is given directly
pe formula.

D19

Petz

1 Part No. 0 190 ..	2 Type	3 Regulator specifications: Regulating voltage at no load[1]) V	4 Regulation range	5 Reg- latin volt at lo V
309 020	UA 14 V 38 A	13,5...14,5	–0,2... +0,1	
309 021	UA 7 V 35 A	6,9... 7,6	0... +0,3	
309 022	UA 7 V 40 A	6,9... 7,6	0... +0,3	
309 023	UA 7 V 45 A	6,9... 7,6	0... +0,3	
309 024	UA 14 V 25 A	13,5...14,5	–0,3... +0,2	
309 025	UA 14 V 30 A	13,5...14,5	–0,3... +0,2	
309 026	UA 14 V 35 A	13,5...14,5	–0,3... +0,2	
309 027	UA 14 V 40 A	13,5...14,5	–0,3... +0,2	
309 028	UA 14 V 20 A	13,5...14,5	–0,3... +0,2	
309 029	UA 14 V 20 A	13,5...14,5	–0,3... +0,2	
309 030	UA 14 V 30 A	13,5...14,5	–0,3... +0,2	
309 031	UA 14 V 40 A	13,5...14,5	–0,3... +0,2	
309 032	UA 14 V 11 A	13,5...14,5	–0,3... +0,2	
309 034	UA 14 V 50 A	13,5...14,5	–0,3... +0,2	
309 036	UA 14 V 30 A	13,5...14,5	–0,3... +0,2	
309 037	UA 14 V 20 A	13,5...14,5	–0,3... +0,2	
309 038	UA 14 V 30 A	13,9...14,9	–0,3... +0,2	
309 039	UA 14 V 50 A	13,5...14,5	–0,3... +0,2	
309 040	UA 14 V 38 A	13,5...14,5	–0,3... +0,2	
309 041	UA 14 V 20 A	13,7...14,7	–0,2... +0,3	
309 045	UA 14 V 20 A	13,6...14,4	–0,2... +0,1	
310 001	UB 14 V 20 A	13,5...14,5	–0,3... +0,2	
310 002	UB 7 V 35 A	6,9... 7,6	–0,1... +0,3	
310 003	UB 7 V 40 A	6,9... 7,6	–0,1... +0,3	
310 004	UB 7 V 50 A	6,9... 7,6	–0,1... +0,3	

[1]) Measure at 2/3 max. field current. When resetting and repairing, set to the mean value ± 0.2 V.

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei
(3.73)

D20
Series

	5	6	7	8	9	10	
cifications		Load current	Current regulator cut-in Load at twice rated generator speed²)		Cutout specifications		Remarks
ion	Regulating voltage at load		cold	warm	Cut-in voltage	Reverse current	
	V	A	A	A	V	A	
+0,1			37 ...41	35,5...40	12,5...13,2	5...11,5	
+0,3			34 ...38	32,5...37	6,0... 6,6	5...11,5	
+0,3			39 ...43	37 ...42	6,0... 6,6	5...11,5	
+0,3			44 ...48	43 ...48	6,0... 6,6	5...11,5	
+0,2			24 ...28	22,5...27	12,5...13,2	5...11,5	
+0,2			29 ...33	27,5...32	12,5...13,2	5...11,5	
+0,2			34 ...38	32,5...37	12,5...13,2	5...11,5	
+0,2			39 ...43	37,5...42	12,5...13,2	5...11,5	
+0,2			19 ...23	17,5...22	12,5...13,2	5...11,5	
+0,2			19 ...23	17,5...22	12,5...13,2	5...11,5	
+0,2			29 ...33	27,5...32	12,5...13,2	5...11,5	
+0,2			39 ...43	37,5...42	12,5...13,2	5...11,5	
+0,2			10,5...13	9 ...12	12,5...13,2	5...11,5	
+0,2			49 ...53	47 ...52	12,5...13,2	5...11,5	
+0,2			29 ...33	27,5...32	12,5...13,2	5...11,5	
+0,2			19 ...23	17,5...22	12,5...13,2	5...11,5	
+0,2			30 ...34	29 ...33	12,5...13,2	5...11,5	
+0,2			49 ...53	47 ...52	12,5...13,2	5...11,5	
+0,2			37 ...41	35,5...40	12,5...13,2	5...11,5	
+0,3			40,5...43	39 ...41,5	12,3...13,2	2... 8	
+0,1			17 ...21	16 ...20	12,5...13,2	5...11,5	
+0,2			19 ...23	17,5...22	12,5...13,2	5...11,5	
+0,3			34 ...38	32,5...37	6,0... 6,6	5...11,5	
+0,3			39 ...43	37 ...42	6,0... 6,6	5...11,5	
+0,3			49 ...53	47,5...52,5	6,0... 6,6	5...11,5	

airing, set to

2) Generator speed = the last number of the type designation x 100 (recent models). In the case of older models, this value is given directly by the type formula.

D 21
Seite 4

1 Part No. 0 190 ..	2 Type	3 Regulator specifications Regulating voltage at no load[1]) V	4 Regulation range	5 Regu-lating voltage at load V	6 Load cur-rent A	7 Current regu Load at twic generator sp cold A
311 001	UC 7 V 35 A	6,9... 7,6	–0,1... +0,3			34...38
311 002	UC 7 V 40 A	6,9... 7,6	–0,1... +0,3			39...43
311 003	UC 7 V 45 A	6,9... 7,6	–0,1... +0,3			44...48
311 004	UC 14 V 16 A	13,5...14,5	–0,2... +0,2			15...19
311 005	UC 14 V 25 A	13,5...14,5	–0,3... +0,2			24...28
311 006	UC 14 V 35 A	13,5...14,5	–0,3... +0,2			34...38
312 001	UD 7 V 35 A	6,9... 7,6	–0,1... +0,3			34...38
312 002	UD 7 V 40 A	6,9... 7,6	–0,1... +0,3			39...43
312 003	UD 14 V 20 A	13,5...14,5	–0,3... +0,2			19...23
312 004	UD 14 V 13 A	13,5...14,5	–0,3... +0,2			10...14
312 005	UD 14 V 16 A	13,5...14,5	–0,3... +0,2			13...17
312 006	UD 14 V 22 A	13,5...14,5	–0,3... +0,2			19...23
312 007	UD 14 V 30 A	13,5...14,5	–0,3... +0,2			28...32
312 008	UD 14 V 30 A	13,5...14,5	–0,3... +0,2			29...33
312 009	UD 14 V 40 A	13,5...14,5	–0,3... +0,2			39...43
312 010	UD 14 V 28 A	13,5...14,5	–0,3... +0,2			25...29
312 011	UD 7 V 23 A	6,9... 7,6	–0,1... +0,3			22...26
312 012	UD 14 V 30 A	13,5...14,5	–0,3... +0,2			29...33
312 013	UD 14 V 25 A	13,5...14,5	–0,3... +0,2			19...23
312 014	UD 14 V 25 A	13,5...14,5	–0,3... +0,2			19...23
313 001	UAM 14 V 38 A	13,5...14,5	–0,3... +0,2			37...41
313 002	UAM 14 V 38 A	13,5...14,5	–0,3... +0,2			37...41
313 003	UAM 14 V 30 A	13,5...14,5	–0,3... +0,2			29...33
313 005	UAM 14 V 25 A	13,5...14,5	–0,3... +0,2			24...28

[1]) Measure at 2/3 max. excitation current. When resetting and repairing, set to the mean value ± 0.2 V.

[2]) Generator speed = the (recent models). In th by the type formula.

Robert Bosch GmbH, 7 Stuttgart 1, Po
Printed in Germany
Imprimé en Allemagne Rép. Féd. par F

D22

	8	9	10	
ent regulator cut-in] at twice rated rator speed[2])		Cutout specifications Cut-in voltage	Reverse current	Remarks
	warm			
	A	V	A	
38	32,5...37	6,0... 6,6	5...11,5	
43	37 ...42	6,0... 6,6	5...11,5	
48	43 ...48	6,0... 6,6	5...11,5	
19	14 ...18	12,5...13,2	5...11,5	
28	22,5...27	12,5...13,2	5...11,5	
38	32,5...37	12,5...13,2	5...11,5	
38	32,5...37	6,0... 6,6	5...11,5	
43	37 ...42	6,0... 6,6	5...11,5	
23	17,5...22	12,5...13,2	5...11,5	
14	9 ...13	12,5...13,2	5...11,5	
17	13 ...17	12,5...13,2	5...11,5	
23	17,5...22	12,5...13,2	5...11,5	
32	26,5...31	12,5...13,2	5...11,5	
33	27,5...32	12,5...13,2	5...11,5	
43	37,5...42	12,5...13,2	5...11,5	
29	23,5...28	12,5...13,2	5...11,5	
26	21 ...25,5	6,0... 6,6	5...11,5	
33	27,5...32	12,5...13,2	5...11,5	
23	17,5...22	12,5...13,2	5...11,5	
23	17,5...22	12,5...13,2	5...11,5	
41	35,5...40	12,1...13,2	5...11,5	
41	35,5...39	12,5...13,2	5...11,5	
33	27,5...32	12,1...13,2	5...11,5	
28	22,5...27	12,1...13,2	5...11,5	

peed = the last number of the type designation x 100
els). In the case of older models, this value is given directly
formula.

tgart 1, Postfach 50 (3.73)
Féd. par Robert Bosch GmbH Hausdruckerei

BOSCH

Generator Regulators
0190 311 001 to 0190 313 005

TEST SPECIFICATIONS 19
VDT-WPE 320/2-25 B
Ed. 4

D23

1 Part No. 0 190 ..	2 Type	3 Regulator specifications Regulating voltage at no load[1] V	4 Regulation range	5 Regulating voltage at load V	6 Load current A	7 Current regulator cut-in Load at twice rated generator speed cold A	8 warm A
350 002	VA 7 V 45 A	7 ... 7,7	−0,1... +0,3	6,2... 7,0	60		
350 005	VA 14 V 30 A	13,8...14,8	−0,2... +0,2	13,1...14,1	45		
350 007	VA 14 V 25 A	13,5...14,5	−0,1... +0,5	12,8...13,8	37		
350 008	VA 7 V 50 A	6,8... 7,5	−0,1... +0,3	6,2... 7,0	65		
350 009	VA 14 V 11 A	13,7...14,7	−0,1... +0,5	12,6...13,6	16,5		
350 012	VA 7 V 50 A	6,8... 7,5	−0,1... +0,4	6,2... 7,0	65		
350 015	VA 14 V 38 A	13,8...14,8	−0,2... +0,2	13,1...14,1	55		
350 018	VA 7 V 50 A	6,8... 7,5	−0,1... +0,4	6,2... 7,0	65		
350 023	VA 14 V 25 A	13,5...14,5	−0,1... +0,5	12,8...13,8	37		
350 024	VA 7 V 40 A	6,8... 7,5	−0,1... +0,3	6,2... 7,0	60		
350 026	VA 14 V 30 A	13,5...14,5	−0,1... +0,5	12,8...13,8	45		
350 027	VA 14 V 16 A	13,6...14,6	−0,3... +0,3	12,9...13,8	25		
350 028	VA 14 V 25 A	13,5...14,5	−0,1... +0,5	12,8...13,8	37		
350 030	VA 7 V 50 A	6,8... 7,5	−0,1... +0,3	6,2... 7,0	65		
350 031	VA 7 V 50 A	6,8... 7,5	−0,1... +0,4	6,2... 7,0	65		
350 032	VA 7 V 50 A	6,8... 7,5	−0,1... +0,4	6,2... 7,0	65		
350 033	VA 14 V 25 A	13,5...14,5	−0,1... +0,5	12,8...13,8	37		
350 037	VA 7 V 50 A	6,8... 7,5	−0,1... +0,4	6,2... 7,0	65		
350 038	VA 14 V 30 A	13,8...14,8	−0,2... +0,2	12,8...13,8	45		
350 040	VA 14 V 38 A	13,8...14,8	−0,2... +0,2	12,8...13,8	55		
350 042	VA 7 V 50 A	6,8... 7,5	−0,1... +0,4	6,2... 7,0	65		

1) Measure at 2/3 max. excitation current; when resetting, particularly after repairing, set to the mean value ±0.2 V. Take reading of regulating voltage immediately after reaching load current. If the load current increases too slowly or the prescribed value is exceeded, the voltage reading is lower than that given in column 5. Repeat the measurement when the resistor has cooled dow.

D 24

BOSCH

GERMANY

Generator Regulators

0 190 350 002 to 0 190 350 083

Archiv VDT

7	8	9	10	
Current regulator cut-in Load at twice rated generator speed		Cutout specifications		Remarks
cold	warm	Cut-in voltage	Reverse current	
A	A	V	A	
		5,9... 6,6	2 ...7,5	
		12,4...13,1	2,5...9,5	
		12,4...13,1	2,5...9,5	
		5,9... 6,6	2 ...8,5	
		12,4...13,1	2,5...9,5	
		5,9... 6,6	2 ...8,5	
		12,1...13,2	2,5...9,5	
		5,9... 6,6	2 ...8,5	
		12,4...13,1	2,5...9,5	
		5,9... 6,6	2 ...8,5	
		12,4...13,1	2,5...9,5	
		12,4...13,1	2,5...9,5	
		12,3...13,2	2 ...9	
		5,9... 6,6	2 ...8,5	
		5,9... 6,6	2 ...8,5	
		5,9... 6,6	2 ...8,5	
		12,3...13,2	2 ...9	
		5,9... 6,6	2 ...8,5	
		12,1...13,2	2,5...6,5	
		12,1...13,2	2,5...9,5	
		5,9... 6,6	2 ...8,5	

TEST SPECIFICATIONS **19**

VDT-WPE 320/2-26 B
Ed. 5

AT 320-2/26

D 25
Seiter

1	2	3	4	5
Part No.	Type	Regulator specifications		
		Regulating voltage at no load[1])	Regulation range	Regulating voltage at load
0 190 ..		V		V
350 044	VA 7 V 50 A	6,8... 7,5	–0,1... +0,4	6,2... 7,0
350 045	VA 14 V 11 A	13,8...14,8	–0,2... +0,2	12,7...13,7
350 046	VA 14 V 16 A	13,8...14,8	–0,2... +0,2	13,1...14,0
350 049	VA 14 V 25 A	13,8...14,8	–0,2... +0,2	12,8...13,8
350 050	VA 14 V 25 A	13,8...14,8	–0,2... +0,2	13,0...14,0
350 051	VA 7 V 50 A	6,8... 7,5	–0,1... +0,4	6,2... 7,0
350 052	VA 14 V 25 A	14,5...14,9	–0,1... +0,4	13,8...14,2
350 054	VA 14 V 30 A	13,8...14,8	–0,2... +0,2	13,1...14,1
350 055	VA 14 V 25 A	13,8...14,8	–0,2... +0,2	13,1...14,1
350 056	VA 7 V 50 A	6,8... 7,5	–0,1... +0,4	6,2... 7,0
350 058	VA 7 V 50 A	6,8... 7,5	–0,1... +0,4	6,2... 7,3
350 059	VA 14 V 30 A	13,8...14,8	–0,2... +0,2	12,8...13,8
350 061	VA 14 V 30 A	13,8...14,8	–0,2... +0,2	12,8...13,8
350 063	VA 14 V 38 A	13,8...14,8	–0,2... +0,2	12,8...13,8
350 065	VA 7 V 50 A	6,8... 7,5	–0,1... +0,3	6,2... 7,0
350 068	VA 14 V 30 A	13,8...14,8	–0,2... +0,2	12,8...13,8
350 079	VA 14 V 30 A	13,8...14,8	–0,2... +0,2	12,8...13,8
350 080	VA 14 V 25 A	13,6...14,5	–0,2... +0,2	12,8...13,8
350 083	VA 14 V 25 A	13,8...14,8	–0,2... +0,2	12,8...13,8
350 084	VA 14 V 30 A	13,8...14,8	–0,2... +0,2	12,8...13,8

[1]) Measure at 2/3 max. excitation current; when resetting, particularly after repairing, set to the mean value ± 0.2 V. Take reading of regulating voltage immediately after reaching load current. If the load current increases too slowly or the prescribed value is exceeded, the voltage reading is lower than that given in column 5. Repeat the measurement when the resistor has cooled down.

Robert Bosch GmbH, 7 Stuttgart 1, Postfach 50
Printed in Germany
Imprimé en Allemagne Rép. Féd. par Robert Bosch GmbH Hausdruckerei (3.73)

D 26
Series

	5	6	7	8	9	10	
specifications		Load current	Current regulator cut-in Load at twice rated generator speed		Cutout specifications		Remarks
...ulation ...e	Regulating voltage at load		cold	warm	Cut-in voltage	Reverse current	
	V	A	A	A	V	A	
...1... +0,4	6,2... 7,0	65			5,9... 6,6	2 ...8,5	
...2... +0,2	12,7...13,7	16,5			12,4...13,1	2,5...9,5	
...2... +0,2	13,1...14,0	24			12,4...13,1	2,5...9,5	
...2... +0,2	12,8...13,8	37			12,3...13,2	2 ...9	
...2... +0,2	13,0...14,0	37			12,4...13,1	2,5...9,5	
...1... +0,4	6,2... 7,0	65			5,9... 6,6	2 ...8,5	
...1... +0,4	13,8...14,2	37			12,1...13,2	2,5...9,5	
...2... +0,2	13,1...14,1	45			12,1...13,2	2,5...9,5	
...2... +0,2	13,1...14,1	37			12,1...13,2	2,5...9,5	
...1... +0,4	6,2... 7,0	65			5,9... 6,6	2 ...8,5	
...1... +0,4	6,2... 7,3	65			5,9...66,6	2 ...8,5	
...2... +0,2	12,8...13,8	45			12,1...13,2	2,5...6,5	
...2... +0,2	12,8...13,8	45			12,1...13,2	2,5...6,5	
...2... +0,2	12,8...13,8	55			12,1...13,2	2,5...6,5	
...1... +0,3	6,2... 7,0	65			5,9... 6,6	2 ...8,5	
...0,2... +0,2	12,8...13,8	45			12,1...13,2	2,5...6,5	
...0,2... +0,2	12,8...13,8	45			12,1...13,2	2,5...6,5	
...0,2... +0,2	12,8...13,8	37			12,1...13,2	2,5...6,5	
...0,2... +0,2	12,8...13,8	37			12,3...13,2	2 ...9	
...0,2... +0,2	12,8...13,8	45			12,1...13,2	2,5...6,5	

...tting, particularly after
...ding of regulating
... the load current
...eeded, the voltage
...eat the measurement

D 27
Satzy

Change in starting motor marking
New performance designation for starting motors (kW instead of HP)

00

VDT-I-001/111 B
Ed. 1 12.1975
Translation of German edition of 3.11.1975

Conversion of performance data

According to West German law all performance data must be converted to the International System of Units (SI) by December 31st 1977. Consequently the HP (PS) value given on Bosch starting motors must be converted into kW. At the same time the previous definition of starting motor performance will be revised. Previous HP values were "nominal power"; the new kW values will represent "maximum power", with reference to the maximum permitted battery size. Thus a straightforward conversion of the old HP values into kW (1 HP = 0.735 kW) is not possible.

After-sales service notes

This conversion is of little relevance for after-sales service, since as from about September 1975 newly-developed Bosch starting motors have not been marked with a performance figure. The conversion for the already-existing starting motor program is intended to take place step-by-step up to the end of 1975. After this the marking will generally comprise only the part number and underneath it the direction-of-rotation arrow and the voltage. The type letters, e.g. EF, JD etc., and the HP value will have disappeared.

Present:	Future:
326 E1	326 E1
BOSCH	BOSCH
made in Germany	made in Germany
0 001 211 992 993	0 001 211 992 993
EF ← 12 V 0,7 PS	← 12 V

This also renders it unnecessary to give the kW performance in the test specification sheets VDT-WPE 510/.. . The first 7 figures of the part number are sufficient information for establishing the nominal values.

A cross-reference between the new and old type designations can be taken from the main Bosch catalog "Electrical Equipment for Engines" Sheet VDT-B 6/1 (Ed. 1). In case of inquiry, please contact your authorized representative.

Published by:
After-sales Service Training Center
Automotive Equipment (KH/VSK)

BOSCH
Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

Changeover to carbon brushes without connecting cable in starting motors

0 001 157 .. – DF 12 V 0.65 kW and 0.7 kW
.. 208 .. – EF 12 V 0.85 kW
.. 211 .. – EF 12 V 0.8 kW
.. 212 .. – EB 12 V 0.8 kW
.. 311 .. – GF 12 V 1 kW and 1.1 kW
.. 312 .. – GF 12 V 1.5 kW
.. 314 .. – GF 12 V 1.5 kW
.. 315 .. – GF 12 V 1.9 kW

As of the end of 1976/beginning of 1977 carbon brush sets of D, E and G starting motors, with a few exceptions, will be provided only with carbon brushes without connecting cable (shunt, flexible). The carbon brushes will have a countersunk solder hole.
Technical Bulletin VDT-BME 512/94 of 2.73 describes in detail the direct soldering of the carbon brushes to the connecting cable.
A comparison is given below:

Carbon brush sets

Old model with connecting cable	New model without connecting cable
1 007 014 117	1 007 014 129
121	127
125	132
2 007 014 018	128
026	126
027	131
039	131
040	130
054	129
055	127

As of the date of changeover the brush holders for the negative brushes will no longer be provided with the solder holes for the connecting cable.
In the case of service-part brush holders only holders complete with welded-on carbon brushes will be supplied.

BOSCH
Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung.

E 1

OVERREVVING OF STARTING MOTORS

VDT-I-001/128 En

1.1981

Replaces 7.1980

of sizes 0 001 15 ..
0 001 20 ..
0 001 21 ..
0 001 31 ..
0 001 35 ..
0 001 36 ..

Possible damage and causes - Warranty procedure

The following faults can occur with the above mentioned starting motors which fail due to "overrevving.":

- Defective roller-type overrunning clutch - no longer engages or is blocked.
- Drive shows blue traces (blued).
- Armature shaft shows traces of "bluing" or seizing around the pinion track, the pinion bushing may be worn out.
- Armature winding or commutator forced out by centrifugal force.

The following may be the cause:

- Ignition and starter switch remains in start position whilst the engine is running.
- Defective cable in the vehicle (connection between cables 30 and 50 or between 15/54 and 50.
- Operating fault (holding the ignition and starter switch or starting switch in the start position although the engine is already running).
- Solenoid switch sticks.

When checking the causes of failure the solenoid switch must first be carefully tested to see if it switches off correctly according to Test Instructions WPE 712/2 (high-voltage test with double rated voltage). If the solenoid switch is in working order, other causes of failure should be looked for.

Warranty procedure

A warranty claim is only justified if there is a fault on the solenoid switch. If there is a fault on a Bosch starting switch, please proceed according to Technical Bulletin VDT-I-342/100 En of 2.1978.

BOSCH Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.

E2

E2

Failure due to excess grease on the relay armature

If too much grease is used on the relay armature when repair work is carried out on starting motors, excess grease gets into the contact chamber of the solenoid switch. This can lead to contact welding or to open circuiting.

To avoid this the relay armature should be lightly greased only on the circumference and never on the front or on the armature guide.

The following grease should be used:

Solenoid switch	Grease
0 331 303 ... 0 331 402 ... without rubber bellows	VS 10 832 Ft - 5 932 240 150 (tube 500 g)
0 331 402 ... with rubber bellows	Ft 1 v 26 - 5 700 005 005 /tube 50 g)

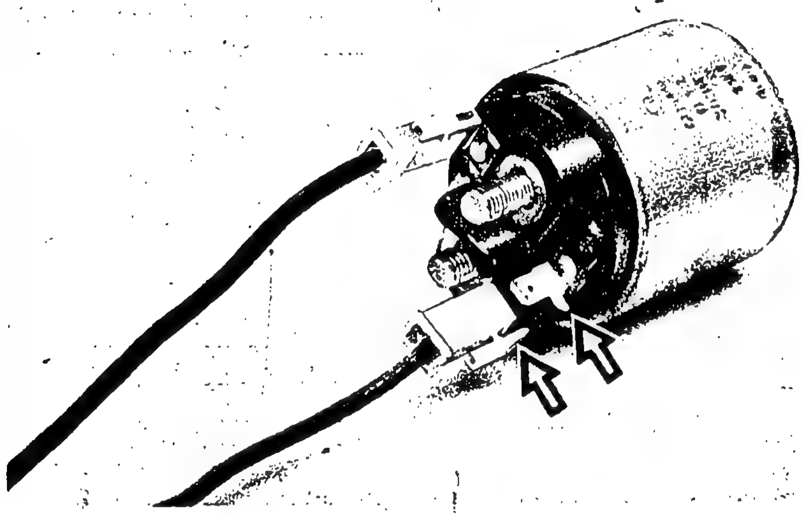
Use only grease Ft 1 v 26 for the solenoid switch with rubber bellows otherwise the rubber bellows will be damaged.

STARTER RELAY WITH INTERLOCKING TERMINALS 15a and 50

VDT-I-001/137/En
4.1984
supersedes edition 3.1984

Since the middle of 1983, interlocking terminals 15a and 50 have been fitted to the starter relay 0 331 303 071/ ..:571.

The interlock consists of a clip with slot on the plastic plug housing and a retaining lug on the blade terminal of the starter relay (see arrows in Figure).



In order to prevent the connections 15a and 50 from being confused with each other, the plug housing of terminal 15a has been provided with an extra lug. In addition, the blade terminals on the starter relay are offset 90° from each other.

When disconnecting the plug-in connections, first of all release the interlock. This type of terminal is being used first of all on VW vehicles (Golf/Rabbit).

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department for
Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

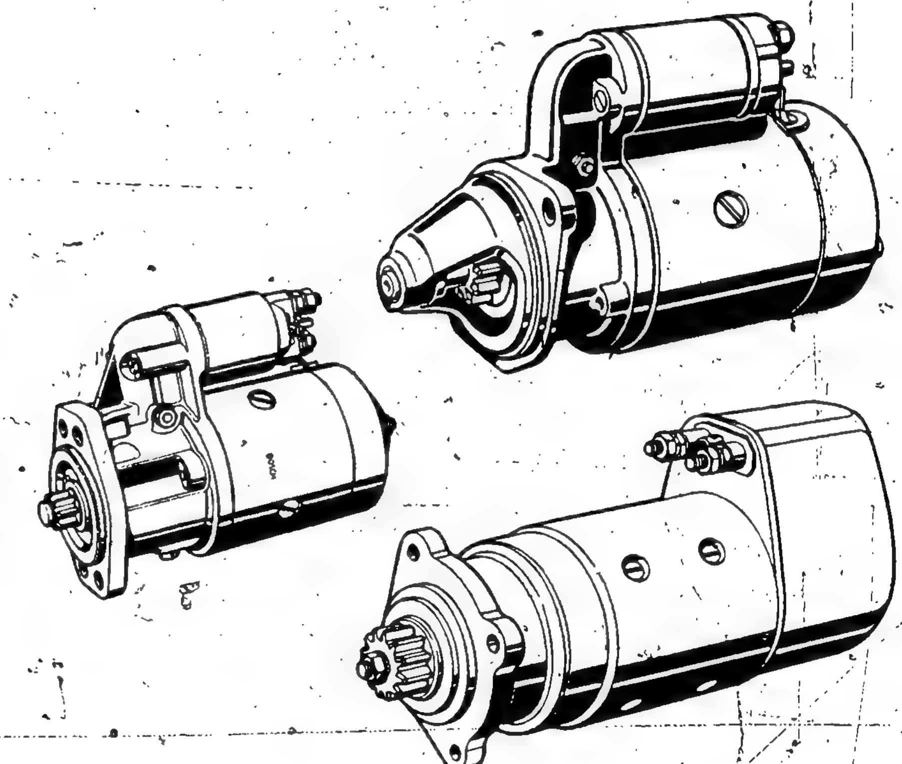
E4

BOSCH

TEST INSTRUCTIONS

00

VDT-WPE 510/2 B
Ed. 2
supersedes 2.66



Starters

E6

E5

Contents

E6

1. Test Equipment

Starter Test Bench up to 15 DIN HP	EFAL 140	0 680 106 . .
Starter Test Bench up to 15 DIN HP	EFAL 30 . .	0 680 100 . .
Starter Test Bench up to 6 DIN HP	EFAL 90 . .	0 680 100 . .
Spring Scale 0...1.2 kgf	KDAW 9991 (formerly EF 1244)	
Spring Scale 0...2.0 kgf	KDAW 9993 (formerly EF 1244 B)	
Spring Scale 0...5.0 kgf	KDAW 9992 (formerly EF 1244 A)	
Spring Scale 5...16 kgf	EF 5206	1 688 130 009
Torquemeter 0.4...1.2 kgf.cm	KDAL 5482 (formerly EFAL 27)	
Torquemeter 1.5...8.0 kgf.cm	KDAL 5485 (formerly EFAL 26)	
Torquemeter 10...25 kgf.cm	EFAL 54	0 681 400 003
Torquemeter 1 5...30 kgf.m	EF 2368 B	0 681 400 007
Shorted-turns Tester	EFAW 90	0 681 169 034
Shorted-turns Tester	EFAW 95	0 681 169 020
Test Panel with Test Prods EFAW 84	EFAW 81 . .	0 681 1 . .
Transformer Panel	EFAW 85 . .	0 681 1 . .

2. General

These instructions contain notes concerning the Starter Test Specification Sheets VDT-WPE 510/2- . . B and general pointers for starter testing.

Further instructions for the testing of,

Sliding armature starters	KG (BNG)	VDT-WJE 511/2 B
	QD (BPD)	VDT-WJE 511/2 B
Rocker starters	JD	VDT-WPE 531/2 B
Relays		VDT-WPE 712/ . .
		VDT-WPE 713/ . .

3. Test Instructions

3.1. Visual Check of Assembled Starter

Damaged parts must be removed. Electrical connections (connecting bolts) must be in flawless condition and all bolt screws and nuts correctly secured (e. g. with cotter pin).

The gear should turn freely on the armature shaft and should not bind or jam.

The shift lever and linkage must not bind or be obstructed in their operation; replace bent shift levers. Re-tap damaged threads.

E7

3.2. Detailed Testing of Disassembled Starter

3.2.1. Excitation winding in starter frame

The windings must not be burned or have solder breaks and must not protrude over the pole shoes.
Check all windings for open circuit with the test and transformer panels.
First disconnect all parallel-connected windings.
Test voltage: 6 V.D. C.
The indicator lamp should light up.

Test all windings for short-circuit to ground with the test and transformer panels.
First disconnect all groundiconnections and pull up the carbon brushes from the commutator.
Test voltage

for 6 and 12 V starters	40 V A. C.
for 24 V starters	80 V A. C.

The indicator lamp must not light up.

3.2.2. Carbon brushes

The carbon brushes must move freely in their guides in the brush holder and are not to be damaged, dirty, or unsoldered. The wear reserve should be 4 mm more than the minimum length specified in the Test Specification Sheets. Worn-out carbon brushes could allow the brush spring or shunt (pigtail) to catch on the brush holder. Always install a complete set of new brushes. Only use original service parts as listed in Service Parts Lists. Severe brush sparking can be caused by out-of-round commutators, protruding commutator insulators, binding or worn-out carbon brushes, insufficient brush pressure or unsoldered armature winding.

3.2.3. Brush pressure

Brush pressure is the spring force with which each brush is pressed upon the commutator. If brush pressure is too high, carbon brush wear and commutator wear is excessive. If the brush pressure is too low, severe brush sparking occurs, the commutator is burned and starter output is insufficient.

The brush pressure is measured with the appropriate spring scale (0 ... 1.2 kgf or 0 ... 2 kgf). Slightly lift the brush spring, along the brush axis, at a point as near as possible to the point of contact with the brush.

Replace worn-out brushes or burnt or damaged brush-springs. Note position in which springs are fitted. Use only original service parts from the Service Parts List.

3.2.4. Minimum brush length

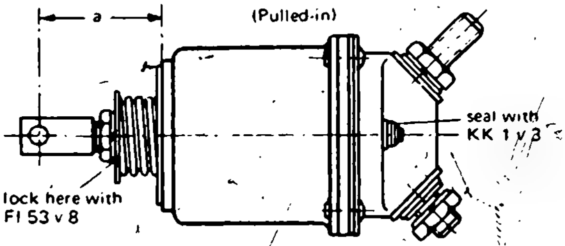
The brush must not be shorter than the specified minimum length. Otherwise the starter will not function correctly (insufficient brush contact with the commutator).
When carrying out repairs always install a complete set of new brushes.

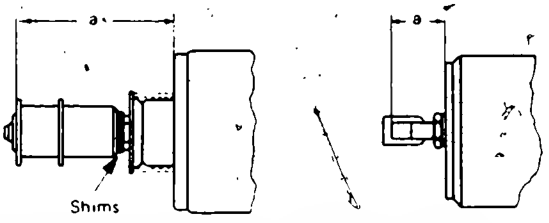
3.2.5. Starter solenoid adjustment
(only with solenoid removed)

If the starter solenoid is wrongly adjusted or the slotted hole is worn, the pinion cannot correctly engage or disengage, the solenoid contacts do not close correctly or the shift lever rubs against the drive end bearing assembly. With the shift lever in the engaged position and when "braking" on the test bench, the shift lever (and hence the solenoid) must have enough freedom of movement in the shift collar so that when the starter is de-energised (at Term. 50) the starter solenoid plunger can return to its initial position. If the shift lever or shift collar bind then the plunger cannot return to its initial position when the pinion is held in the ring gear by flank pressure.

Dimension "a" should, if possible, be adjusted before fitting the solenoid to the starter. If it is not possible to adjust "a" ensure that the slotted hole is not worn.

Dimension "a" is given In the Test Specifications only if an adjustable solenoid is fitted, "a" can also be taken from the Test Specifications for the solenoid.





3.2.6. Contact erosion reserve

The contact erosion reserve is the distance the plunger has to travel from making contact with the moving contact until being stopped mechanically.

If the erosion reserve is insufficient it is not certain that the starter will receive full current e. g. in the case of tooth-on-tooth engagement.

3.2.7. Minimum pull-in voltage of starter solenoid

At the voltage specified the solenoid plunger must pull-in.

Test at room temperature.

If the starter solenoid current is interrupted the solenoid plunger must release.

3.2.8. Armature

The armature must not touch the pole shoes or excitation windings.

Runout: max. 0.05 mm (0.002 in)

Test the armature for interturn short-circuits with Shorted-turn Tester.

Test commutator and winding for short-circuit to ground with Test Panel and Transformer Panel.

Test voltage	
for 6 V and 12 V armatures	40 V A. C.
for 24 V armatures	80 V A. C.

3.2.9. Commutator

The brush contact surface is to be of a uniform blue-gray colour and must be clean and free from oil.

The commutator must not be out-of-round or burnt.

Runout: max. 0.03 mm (0.0012 in).

If the commutator has to be turned down, the minimum diameter is to be taken from the appropriate Repair Instructions. No insulation is to protrude from between the commutator segments; if it does undercut it with an undercutting saw.

3.2.10. Axial play of armature

This is the axial travel (play) of the armature in its bearings. Incorrect axial play results in increased wear in the bearings and to some extent in malfunction of the armature brake. Axial play is adjusted by means of shims on the armature shaft. Care should be taken, on starters with armature brake, that the armature braking torque is adhered to. Axial play is measured by moving the armature, part of the travel is spring-loaded, from one end stop to the other.

3.2.11. Armature braking torque

Armature braking torque is made up of carbon brush friction and bearing friction as well as the braking torque of the oil seal (if present) and the armature brake (if present).

Excessive braking torque results in additional wear, and overheating, of the armature brake.

If the braking torque is too low the starter stop time is too long, also when the engine overruns it will drive the starter to excessive speeds.

The armature braking torque is measured, on the assembled starter and against the direction of starter rotation, with a Torquemeter (0.4 ... 1.2 kgf.cm or 1.5 ... 8 kgf.cm).

3.2.12. Overrun torque

The value specified under "Overrun torque" is the torque necessary to turn the pinion, with starter assembled, in the direction of starter rotation when the armature is stationary.

If the overrun torque is too small it is possible that the clutch will not positively connect.

If the overrun torque is too high the engine, when it overruns, drives the armature to excessive speeds which can destroy it.

The overrun torque is measured, with the armature stationary and in the direction of starter rotation, with a Torquemeter (0.4 ... 1.2 kgf.cm, 1.5 ... 8 kgf.cm or 10 ... 25 kgf.cm). On K-type and Q-type starters the pinion must be at least 10 mm (0.4 in) forward when measuring.

3.2.13. Overload protection

The overload protection on starters with disc clutches protects the pinion and ring gear from overload caused by engine recoil. The overload protection is inoperative at starter stall torque.

A disc clutch whose slip torque is set too high is ineffective and engages too late. If the overload protection slip torque is set too low the disc clutch slips before the starter delivers its maximum torque.

The slip torque is set by means of shims. Fitting details and other instructions are to be taken from respective Repair Instructions.

Slip torque is measured, against the direction of starter rotation and with the armature removed and securely clamped, using a Torquemeter EF 2368 B.

3.2.14. Pinion clearance

Pinion clearance on K-type and Q-type starters is tested and set according to the respective Repair Instructions.

3.2.15. Bearings

Ball and roller bearings should show no indents or craters on the running surfaces. Proceed according to respective Repair Instructions when replacing worn-out, unusable, plain bearings (self-lubricating bearings). Lubricate ball or roller bearings according to WJE 501/9 B or respective Repair Instructions.

3.3. Testing on starter test bench

3.3.1. General

The electrical Test Specifications depend on the battery condition (capacity and state of charge) and on the test duration (starter heating and battery discharge). The Test Specifications are valid only in conjunction with the Starter Test Bench and cannot be applied to the starter when mounted on the engine or installed in the vehicle. The capacity of the Test Bench battery is too low for the largest starters to produce their maximum power. The long cables, which are unavoidable in the Test Bench, also influence the performance of the starter. Therefore the test duration is to be kept as short as possible and the battery is to be in perfect condition and at least three-quarters charged.

Battery capacity as near as possible to 143 Ah
Acid specific gravity (at 20°C/68° F) min. 1.24 g/cm^3
Acid specific gravity (in tropical climates) min. 1.19 g/cm^3

The readings taken on defective starters differ considerably from the Test Specifications. In case of doubt test the excitation windings and armature windings for open circuit, interturn short-circuit and short-circuit to ground.

3.3.2. Circuitry

The internal circuitry of the various starter types is to be taken from the Test Specifications VDT-WPE 510/2-11 B. The electrical connection for testing on the Starter Test Bench is shown in Section 3.4.

3.3.3. Backlash*)

Backlash is the distance (play) between the flanks of the pinion and the ring gear when engaged.

If the backlash is too small, severe noise and wear result; if excessive, the stress on the teeth is so large that they may break off. Pinion and ring gear must have the same module.

3.3.4. Pinion to ring gear clearance*)

Pinion to ring gear clearance is the distance from the ring gear to the side of the pinion nearest to the ring gear, with the starter at rest.

If this clearance is excessive the pinion teeth do not penetrate far enough into the ring gear; pinion teeth and ring gear teeth have insufficient working flank contact area and as a result are overloaded on one side.

A minimum pinion to ring gear clearance is necessary. This is to ensure that the pinion disengages correctly, that the pinion does not hit against the rotating ring gear during heavy vibration, and that the pinion cannot penetrate so far that the pinion shaft comes up against the ring gear.

---

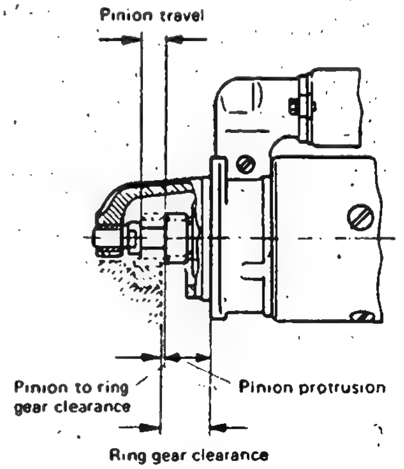
*) Note

The **ring gear clearance**, as well as the number of pinion teeth and the pinion module, is given for all starters in the product "Kennlisten":
The ring gear clearance is the distance between the ring gear (side nearest to the pinion) and the starter register shoulder (on starters without flange) or the starter flange face. Ring gear clearance is dependent on engine design.

Pinion protrusion is the distance between the pinion (side nearest to the ring gear) and the starter register shoulder (on starters without flange), or the starter flange face. It is less than the ring gear clearance by the value of the pinion to ring gear clearance. Pinion protrusion can be measured on the starter when assembled.

Pinion travel is the total travel of the pinion between rest position and engaged position. It should exceed the pinion to ring gear clearance by approx. the pinion facewidth. This ensures that the pinion, when engaged, penetrates with maximum possible facewidth into the ring gear. For this reason ring gear and pinion are not to be turned down.

Ring gear clearance = pinion to ring gear clearance plus pinion protrusion.
Pinion travel = pinion to ring gear clearance plus pinion facewidth.



Backlash and **pinion to ring gear clearance** cannot be adjusted on the flange-mounted starters common today.

Backlash can only then be correct when the prescribed pinion (number of teeth and module) is fitted.

E10

3.3.5. No-load test

Clamp the starter on the Test Bench so that the pinion cannot engage with the ring gear when the starter is operated.
Electrical connections according to Section 3.4.
Measure current draw, voltage, and starter speed.
In the following table possible sources of defects are given in case the values measured do not comply with the Test Specifications.

Defect	Cause
Starter speed and current draw too low	Battery discharged – high voltage-drop at starter solenoid contacts, at the terminals or between commutator and brushes – armature winding unsoldered – open-circuit in armature – brushes binding or worn-out
Speed too low, current draw too high (severe heating)	Interturn short-circuit in excitation winding or in armature – excessive friction due to binding at bearings, oil seal, armature brake or due to excessive brush pressure
Severe brush sparking	Out-of-round commutator – protruding commutator insulators – commutator unsoldered
Voltage too low	Battery discharged – contact resistance in the cables, if necessary make ground connection from starter to test bench

3.3.6. Lock test

Test bench rim gear and starter pinion must have the same tooth system (same module); effect if necessary by fitting appropriate ring gear on Test Bench.

Pay attention to backlash and pinion to ring gear clearance.
When checking engagement of pinion with ring gear allow the pinion to engage several times. The pinion must engage smoothly with the ring gear without blocking and without "chatter".

Switch on the starter and brake it until stationary, read current draw and voltage. This test should be of very short duration, max. 1–2 seconds.

The first (upper) current and voltage specifications given for each starter model in the Test Specifications are only valid for a 3/4-charged battery.

The readings obtained may vary from the test specifications depending on the condition and state of charge of the battery as well as on the electrical condition of Test Bench, cables and connections. For this reason a second (lower) set of specifications are given for lower voltages. If even lower readings are measured then the battery must be recharged **in order to obtain exact readings.**

Intermediate values can be guessed at or derived from the formula

$$I = \frac{I_x \cdot U}{U_x}$$

where

I = current to be calculated (to be compared with the tolerance range given in the Test Specifications)

I_x = current measured
U_x = voltage measured
U = voltage specified in Test Specifications

Example: **Starter type JD 12 V 1.8 DIN HP**
Current measured, I_x = 630 A
Voltage measured, U_x = 6 V
Voltage specified, U = 6.5 V

Current calculated $I = \frac{630 \times 6.5}{6} = 680$ A

Comparison with the values given in the Test Specifications show that the current calculated lies within the permissible tolerance (580 ... 700 A).

The following table gives possible sources of defects in the case of variations in current draw:

Defect	Cause
Current draw too high	Interturn short-circuit of short-circuit to ground
Current draw too low	Open circuit in a coil section of excitation winding, brush binding, armature winding unsoldered, broken commutator connection, battery discharged

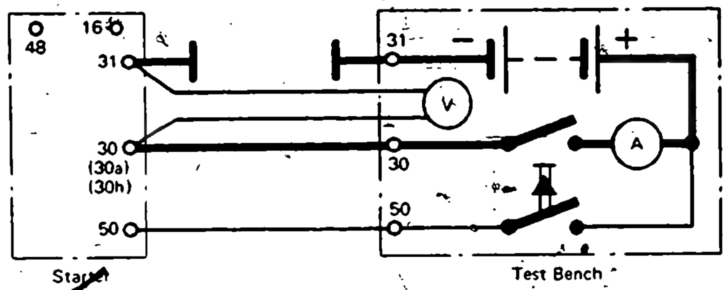
3.3.7. Load test

This test is sufficient as functional test. Mount the starter and connect as for lock test, Section 3.3.6. Switch on starter and brake it, but do not bring to a standstill.

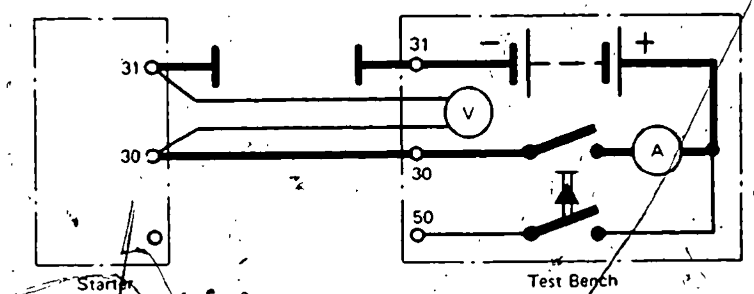
Defect	Cause
Severe brush sparking	Out-of-round commutator, interturn short-circuit in the excitation winding or armature winding, open-circuit in armature

3.4. Test Bench Connection

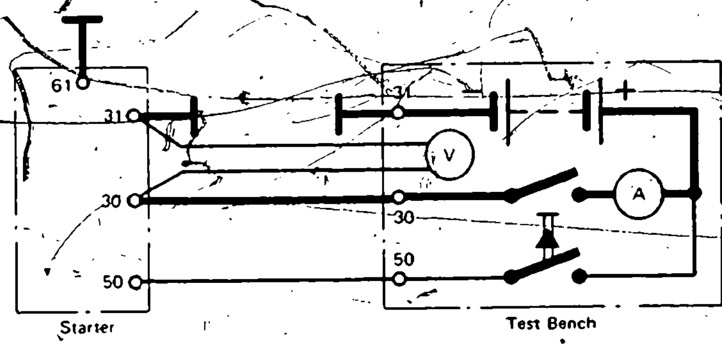
3.4.1. General



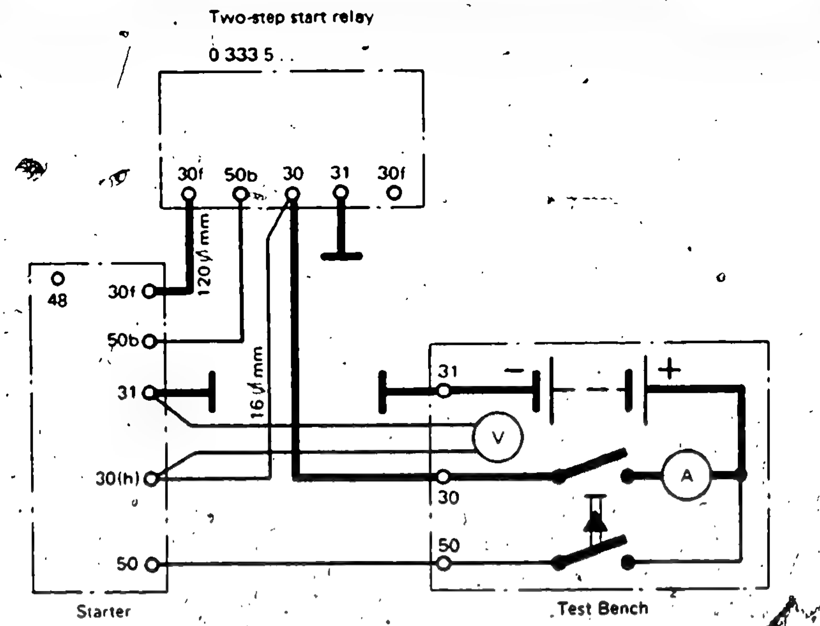
3.4.2. CD Starter



3.4.3. QB Starter

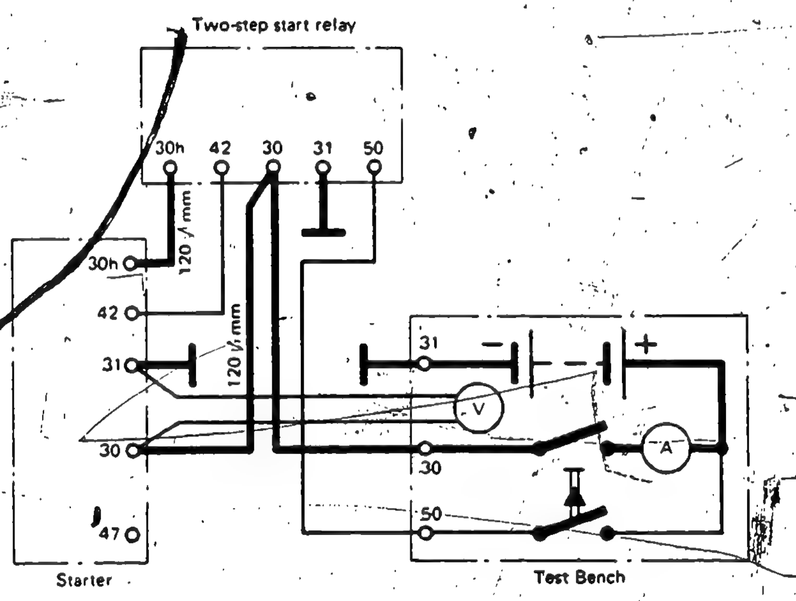


3.4.4. Parallel-operation starters



3.4.5. DTB and DTG Starters

For testing the reversal winding connect Terminal 50 of the Test Bench with Terminal 47 of the starter.



3.4.6. CB Starter
see Repair Instructions VDT-WJE 501/10 B

After-sales Service Instructions

Repairs

00

VDT-W-001/100 En
Ed. 3

Starting motors

protected against oil and water

0 001 203 . .
0 001 204 . .
0 001 306 . .
0 001 308 . .
0 001 355 . .
0 001 357 . .
0 001 359 . .
0 001 360 . .
0 001 364 . .
0 001 380 . .
0 001 401 . .
0 001 402 . .
0 001 410 . .
0 001 411 . .
0 001 501 . .
0 001 510 . .
0 001 600 . .
0 001 601 . .
0 001 604 . .
0 001 606 . .
0 001 607 . .
0 001 608 . .
0 001 611 . .

BOSCH After-sales Service Automotive Equipment

This publication has been redesigned with the forthcoming change-over to microfilm in mind.
When a publication has been transferred to microfilm, the screen will be filled completely by a quarter of a printed publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference is constantly being made to a particular illustration.
Until the change-over to microfilm, we have slightly reduced the size of the print and of the illustrations.

Automotive Equipment - After-Sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1

Published by: After-Sales Service
Department for Training and Technology (KH/VSK)
Editorial closing 8.1980

Please direct questions and comments concerning the contents to our authorized representative in your country.
This publication is only for the use of the Bosch after-sales service organization, and may not be passed on to third parties without our consent.

Printed in the Federal Republic of Germany.
Imprimé en République Féderale d'Allemagne
par Robert Bosch GmbH.
(10.1980)

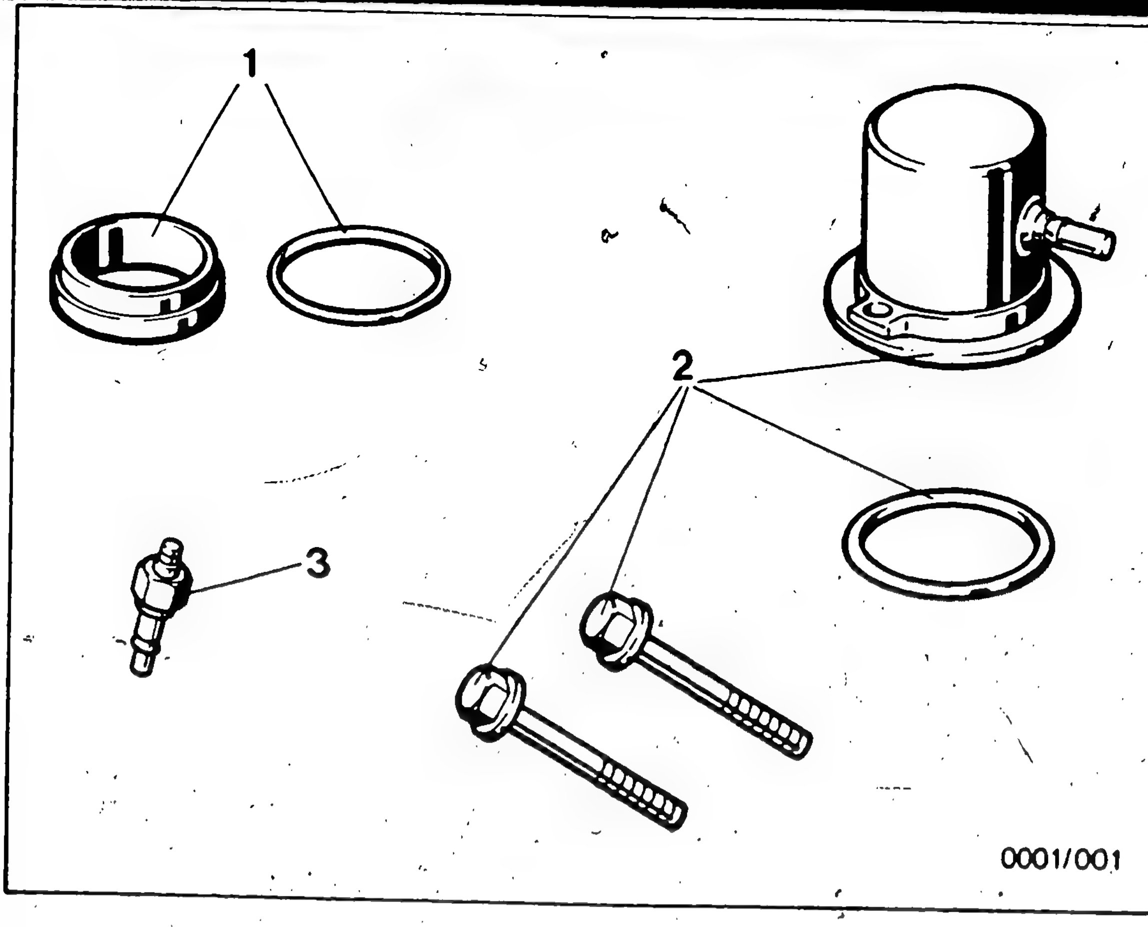
E 15

Contents

Coordinate

Section

E 16

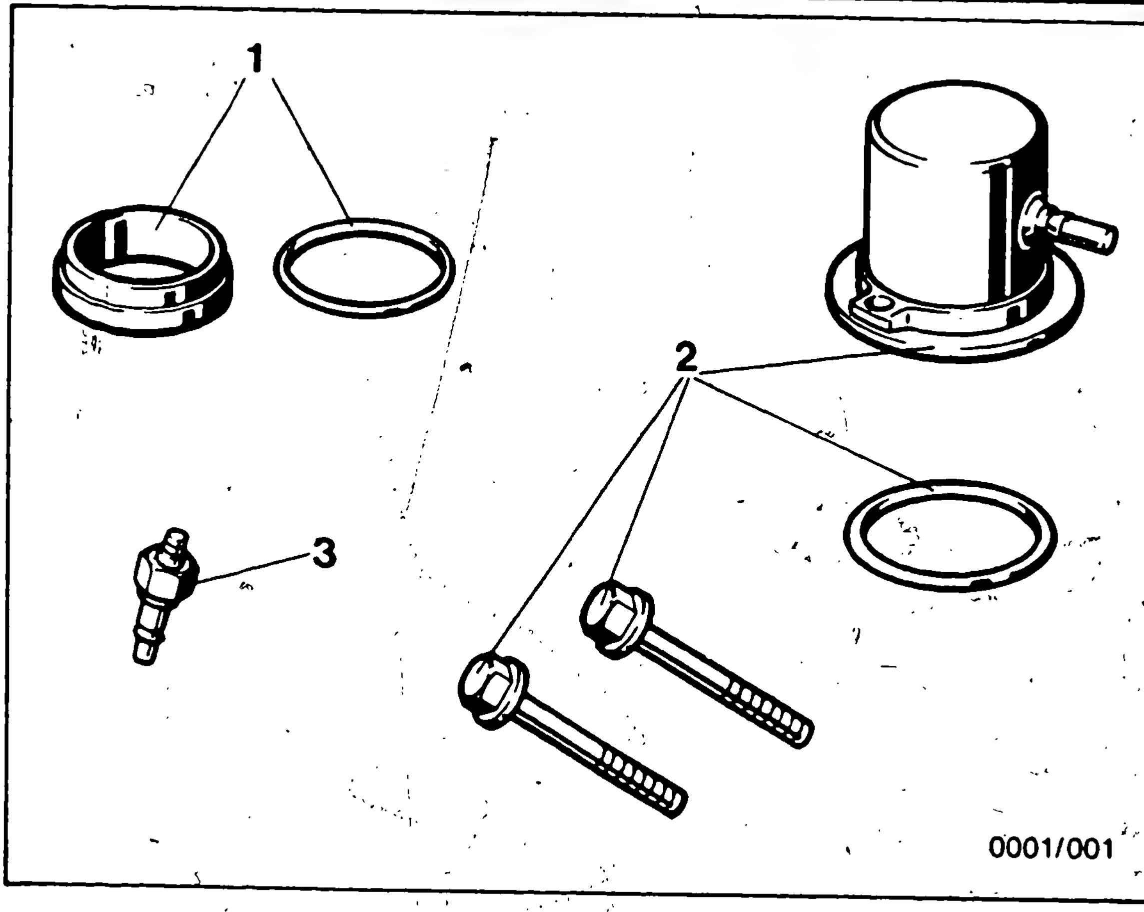


1. Necessary testing devices and sealants

Testing device EFAL 74 0 681 200 002
consisting of:

1 = Intermediate ring with seal ring	for starting motor 0 001 2..(ED)
2 = Covering cap with screws and seal ring	for starting motor 0 001 2..(ED) 0 001 3..(GE, JD)
3 = Test connection with seal ring. You must manufacture covering caps yourself for these starting motors	for starting motor 0 001 4..(KB, KG) 0 001 5..(QB, QD) 0 001 6..(TB, TF)

E 17



1.1 Necessary sealants

Sealing paint	FI 58 v 3	
	0.5 kg tin	5 722 719 505
	1.0 kg tin	5 722 719 510
Sealing putty	Kk 1 v 3	
	0.5 kg tin	5 703 452 150
	1.0 kg tin	5 703 452 210
Sealing compound "Hylomar"	VS 9844 Kk	
	25 g tube	5 927 350 002

E 18

2. Table of starting motors protected against oil and water

Part no.	Type	Type of protection
0 001 203 011	ED 12 V	■
204 002	ED 12 V	■
306 013	GE 12 V	■
308 001	GE 24 V	■
004	GE 24 V	■
308 006	GE 24 V	■
100	GE 24 V	■
355 003	JD 24 V	■
004	JD 24 V	■
007	JD 24 V	■
355 010	JD 24 V	■
017	JD 24 V	■
018	JD 24 V	■
357 002	JD 12 V	● 2)
359 023	JD 12 V	○
359 031	JD 12 V	○
035	JD 12 V	○
050	JD 12 V	○
054	JD 12 V	○
059	JD 12 V	○
359 066	JD 12 V	○
098	JD 12 V	○
360 014	JD 24 V	■
023	JD 24 V	○
025	JD 24 V	○

1) ● Protection against heavy splash water
■ Protection when immersed
○ Protection against splash oil
◇ Protection against pressure oil

2) Test pressure under covering cap at drive end = 0.8 bar

3) Test pressure 0.3 bar

4) Test pressure under covering cap at drive end = 0.2 bar

5) Test pressure 0.55 bar

19

Part no.	Type	Type of protection
0 001 360 030	JD 24 V	■
040	JD 24 V	○
052	JD 24 V	■
364 003	JD 24 V	■
380 001	JD 12 V	○
401 068	KG 12 V	○
401 069	KG 12 V	○
074	KG 12 V	●
402 025	KG 24 V	■ 3)
026	KG 24 V	■ 3)
027	KG 24 V	■
402 028	KG 24 V	■
029	KG 24 V	■
033	KG 24 V	■
036	KG 24 V	■
038	KG 24 V	■
402 039	KG 24 V	■
045	KG 24 V	○
047	KG 24 V	■
048	KG 24 V	■○
073	KG 24 V	■○
084	KG 24 V	○
402 085	KG 24 V	■
410 005	KB 24 V	●
026	KB 24 V	■
027	KB 24 V	●
028	KB 24 V	■

1) ● Protection against heavy splash water
■ Protection when immersed
○ Protection against splash oil
◇ Protection against pressure oil

2) Test pressure under covering cap at drive end = 0.8 bar

3) Test pressure 0.3 bar

4) Test pressure under covering cap at drive end = 0.2 bar

5) Test pressure 0.55 bar

E 20

Part no.	Type	Type of protection
0 001 410 032	KB 24 V	■
035	KB 24 V	■ ○
040	KB 24 V	●
043	KB 24 V	■
047	KB 24 V	● ○
410 049	KB 24 V	●
051	KB 24 V	●
052	KB 24 V	● ○
058	KB 24 V	●
065	KB 24 V	○
410 074	KB 24 V	● ○
076	KB 24 V	● ○
077	KB 24 V	○ ◇
080	KB 24 V	● [4]
081	KB 24 V	● [4]
410 085	KB 24 V	● [4]
086	KB 24 V	■
094	KB 24 V	● ○
102	KB 24 V	○
103	KB 24 V	○
411 001	KB 24 V	○
002	KB 24 V	○
003	KB 24 V	○
004	KB 24 V	○
008	KB 24 V	■

1) ● Protection against heavy splash water
■ Protection when immersed
○ Protection against splash oil
◇ Protection against pressure oil

2) Test pressure under covering cap at drive end = 0.8 bar

3) Test pressure 0.3 bar

4) Test pressure under covering cap at drive end = 0.2 bar

5) Test pressure 0.55 bar

E21

Part no.	Type	Type of protection
0 001 411 010	KB 24 V	●
011	KB 24 V	○
012	KB 24 V	●
017	KB 24 V	●
018	KB 24 V	○ ◇
501 027	QD 24 V	■
034	QD 24 V	■
510 007	QB 24 V	○
010	QB 24 V	○
011	QB 24 V	○
510 012	QB 24 V	○
013	QB 24 V	■
014	QB 24 V	■
510 012	QB 24 V	○
013	QB 24 V	■
020	QB 24 V	■
600 010	TB 24 V	■
012	TB 24 V	■
601 002	TB 24 V	■
601 011	TB 24 V	■
012	TB 24 V	■
015	TB 24 V	■
024	TB 24 V	●
025	TB 24 V	○ ●
604 003	TB 72 V	●
005	TB 72 V	●
008	TB 72 V	●
009	TB 72 V	●
606 003	TB 110 V	●

1) ● Protection against heavy splash water
■ Protection when immersed
○ Protection against splash oil
◇ Protection against pressure oil

2) Test pressure under covering cap at drive end = 0.8 bar

3) Test pressure 0.3 bar

4) Test pressure under covering cap at drive end = 0.2 bar

5) Test pressure 0.55 bar

E22

Part no.	Type	Type of protection
0001 606 004	TB 110 V	●
006	TB 110 V	●
007	TB 110 V	●
607 003	TB 50 V	●
004	TB 50 V	●
608 002	TF 24 V	■
608 003	TF 24 V	■
004	TF 24 V	■
005	TF 24 V	■ 5) ◇
006	TF 24 V	■
611 001	TF 24 V	■ ○
002	TF 24 V	■ ○
613 001	TF 24 V	■ ○ 4)

1) ● Protection against heavy splash water
■ Protection when immersed
○ Protection against splash oil
◇ Protection against pressure oil
2) Test pressure under covering cap at drive end = 0.8 bar
3) Test pressure 0.3 bar
4) Test pressure under covering cap at drive end = 0.2 bar
5) Test pressure 0.55 bar

E 23

3. General instructions

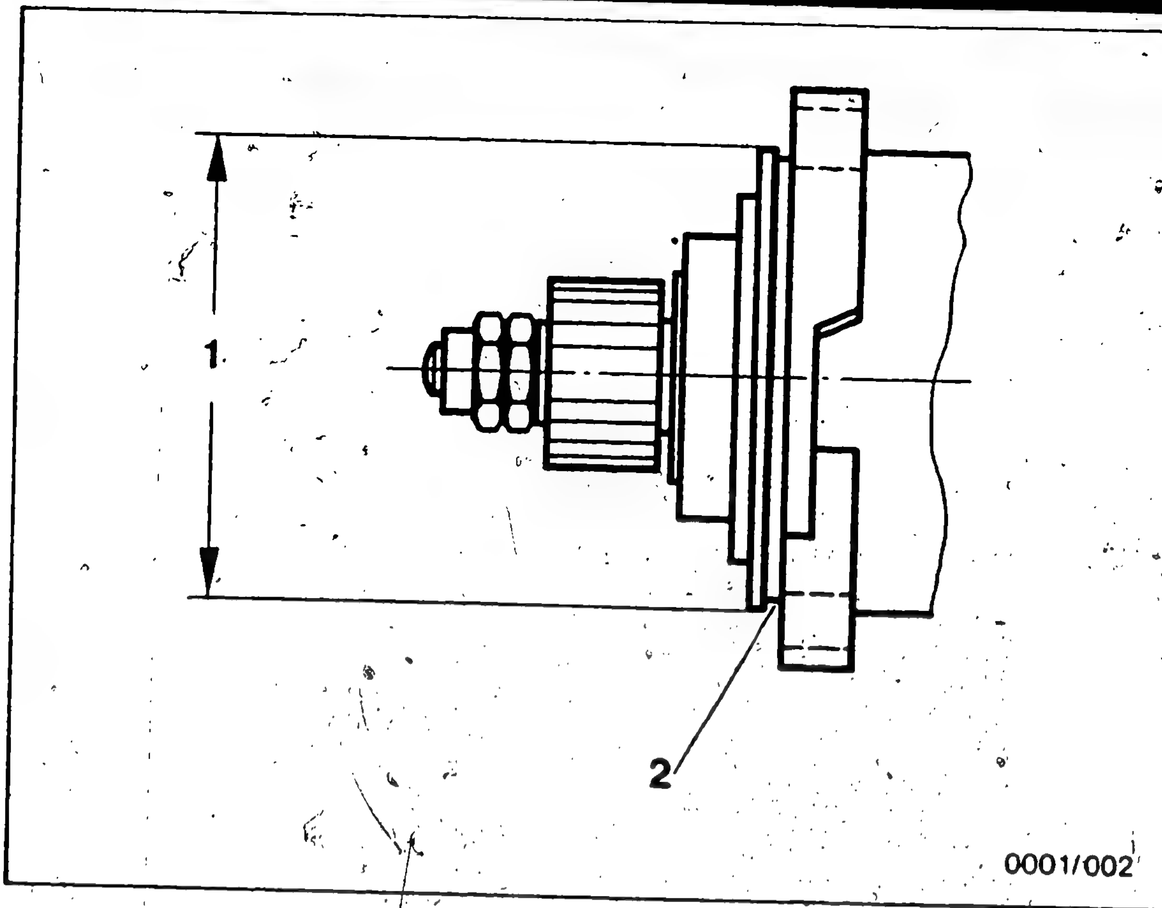
●= Protection against heavy splash water - Protection against splash water (with considerable force from any direction), corresponds to degree of protection IP-4A During repair, the end cover (collector side), the housing and the solenoid switch mounted thereon must be carefully sealed with Kk 1 v 3 or Hylomar. A special test is either not necessary or shown, see table (para. 2).

■= Protection during immersion - Protection during immersion in water under stated conditions of pressure and time, corresponds to degree of protection IP-7 During repair all bearing and housing joints must be carefully sealed with Kk 1 v 3 or Hylomar. Test according to para. 5.

◇ ○ = Protection against splash and pressure oil - There are no generally valid protection regulations for these starting motors, although usage necessitates a particular degree of sealing on the drive side. Test according to para. 4.

All starting motors are constructed according to the regulations for protection against splash and spray water. They have no special designation and require no special testing. In the case of every starting motor listed in the table (section 2), all the seals must be replaced whenever the starting motor is repaired, and when it is reassembled all the joints must be sealed with Kk 1 v 3. For information concerning particular places to which attention must be paid when sealing for a given starting motor, please consult the relevant service parts list.

E 24



1 = Pilot

2 = Groove for seal ring

In the case of starting motors with flange mounting, the groove (2) in the pilot (1) of the drive end shield for the seal ring must be thoroughly examined; it must not be damaged in any way. (See illustration).
After reassembly all joints in the starting motor must be coated with sealing paint FI 58 v 3.
Electrical and mechanical testing should be conducted according to the test instructions for starting motors.
Depending on their application some starting motors require a particular type of protection, which must be borne in mind when carrying out repairs or testing.

E 25

Degrees of protection for protection against water according to DIN 40 050 S

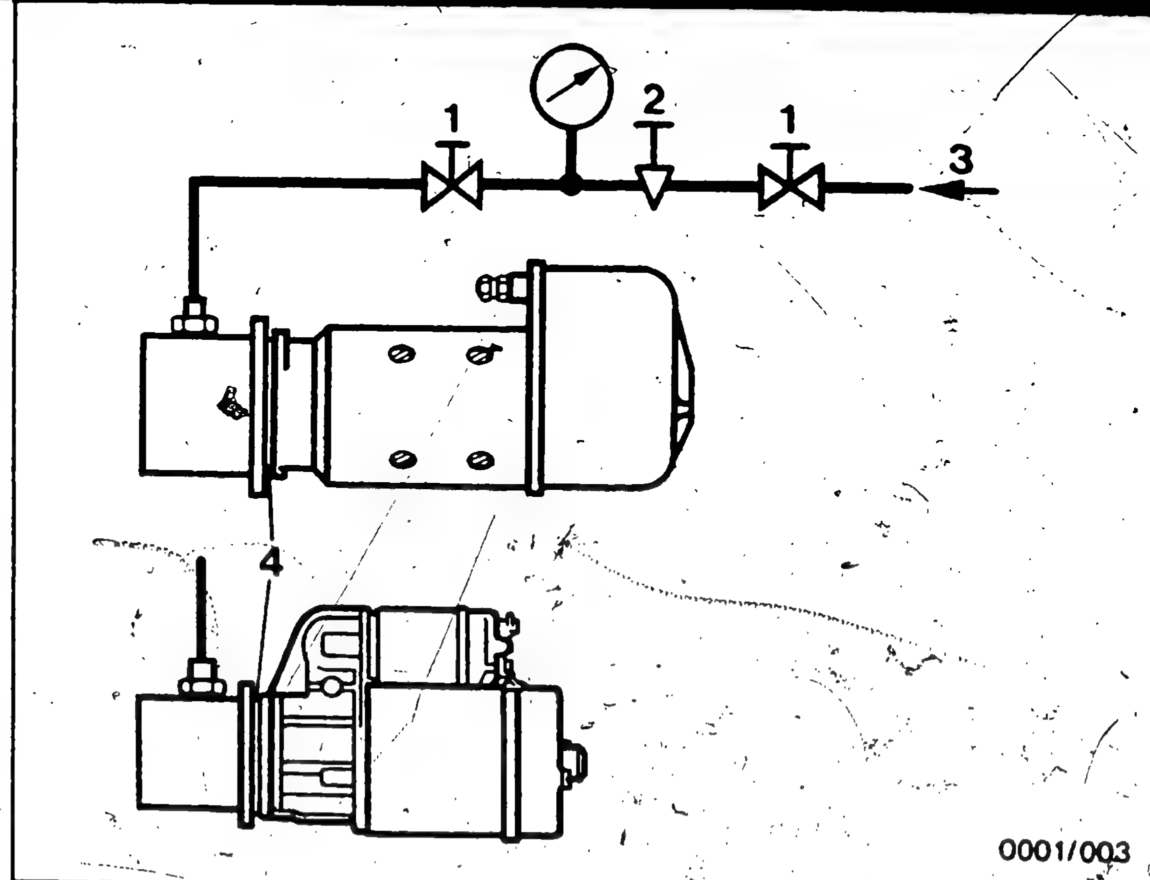
Degree of protection	Designation	Definition
IP-0	No protection	No special protection.
IP-3	Protection against spraying water	Water falling as a spray at an vertical shall have no harmful
IP-4	Protection against splashing water	Water which splashes against t shall have no harmful effect.
IP-4A●	Protection against heavy splash water	Water which splashes with cons motor from any direction shall
IP-6	Protection during flooding	In the case of temporary flood not enter the starting motor i
IP-6A	Protection against strong water jets	A jet of water from a nozzle w motor from any direction, shal
IP-7■	Protection during immersion	Water must not enter in a harm is immersed in water under sta
IP-8	Protection during submersion	Water must not enter in a harm is submerged in water under a indefinite time.

E 26 E 28

tion against water according to DIN 40 050 Sheet 9

	Definition
	No special protection.
t	Water falling as a spray at an angle $\leq 60^\circ$ with respect to the vertical shall have no harmful effect.
t	Water which splashes against the starting motor from any direction shall have no harmful effect.
t heavy	Water which splashes with considerable force against the starting motor from any direction shall have no harmful effect.
	In the case of temporary flooding, e.g. in heavy seas, water must not enter the starting motor in harmful quantities.
t strong	A jet of water from a nozzle which is projected against the starting motor from any direction, shall have no harmful effect.
g	Water must not enter in a harmful quantity when the starting motor is immersed in water under stated conditions of pressure and time.
g	Water must not enter in a harmful quantity when the starting motor is submerged in water under a specified pressure and for an indefinite time.

E 28



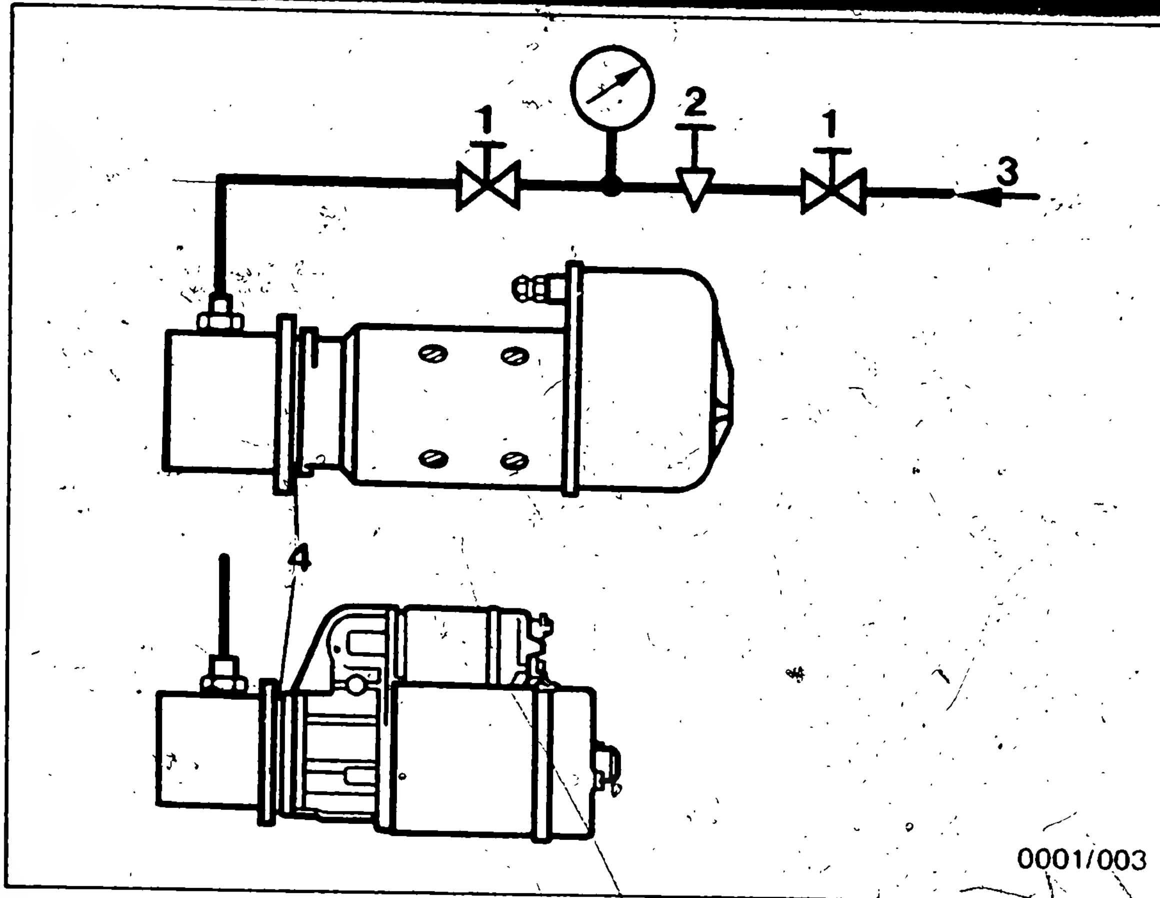
1 = Shut-off valve
3 = Compressed air

2 = Pressure regulator
4 = Seal the covering cap with seal ring

4. Testing starting motors protected against splash and pressure oil ○ ◇

4.1 Mount the covering cap together with the seal ring on the drive side. Feed compressed air (0.2 bar) into the covering cap. The covering cap must be completely air-tight (See illustration).

E27



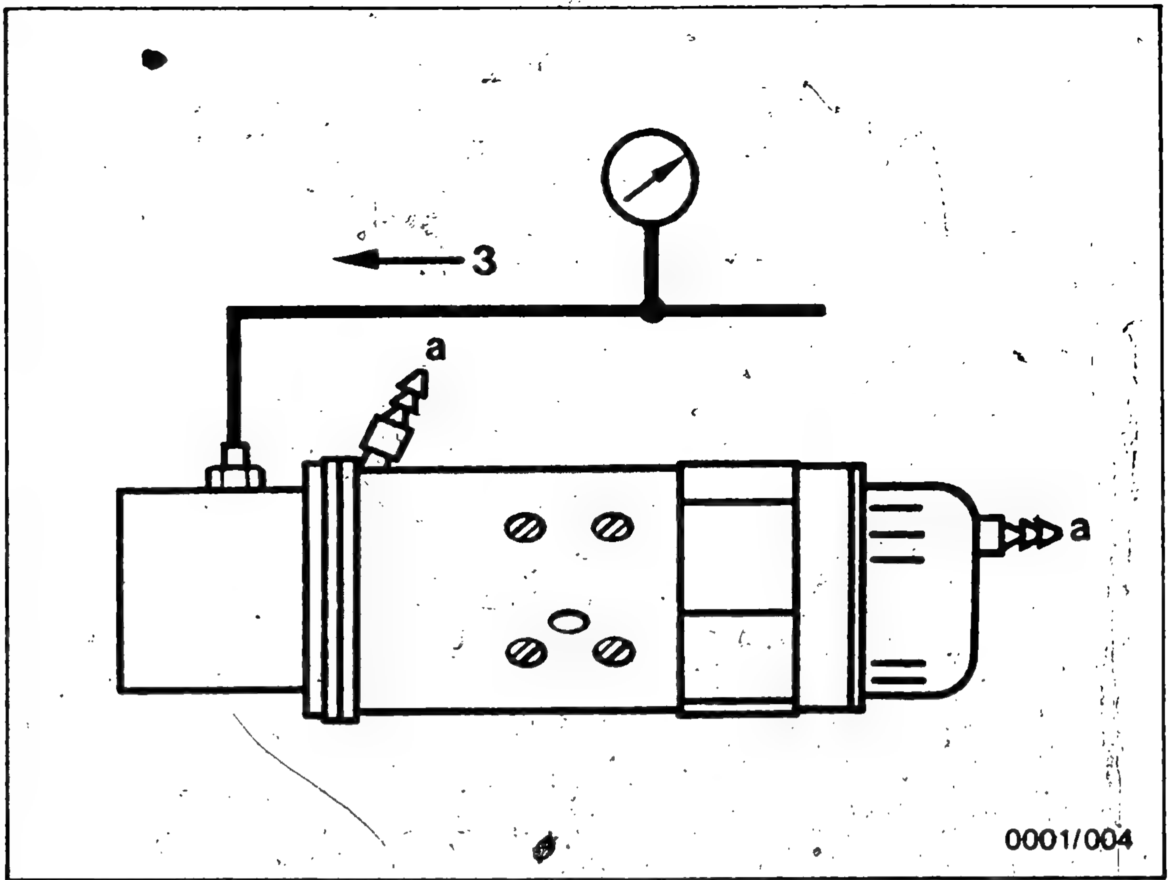
1 = Shut-off valve
3 = Compressed air

2 = Pressure regulator
4 = Seal the covering cap with seal ring

4.2 Pressure drop test

4.2.1 Increase compressed-air pressure to 0.5 bar. Close the shut-off valve and check the pressure drop.
In the case of covering caps with a volume of < 1 dm³, the pressure must not drop below 0.05 bar inside 5 secs for starting motors with protection against splash oil (10 secs for starting motors with protection against pressure oil).
In the case of covering caps with a volume of < 3 dm³, the pressure must not drop below 0.05 bar inside 10 secs for starting motors with protection against splash oil (20 secs for starting motors with protection against pressure oil).

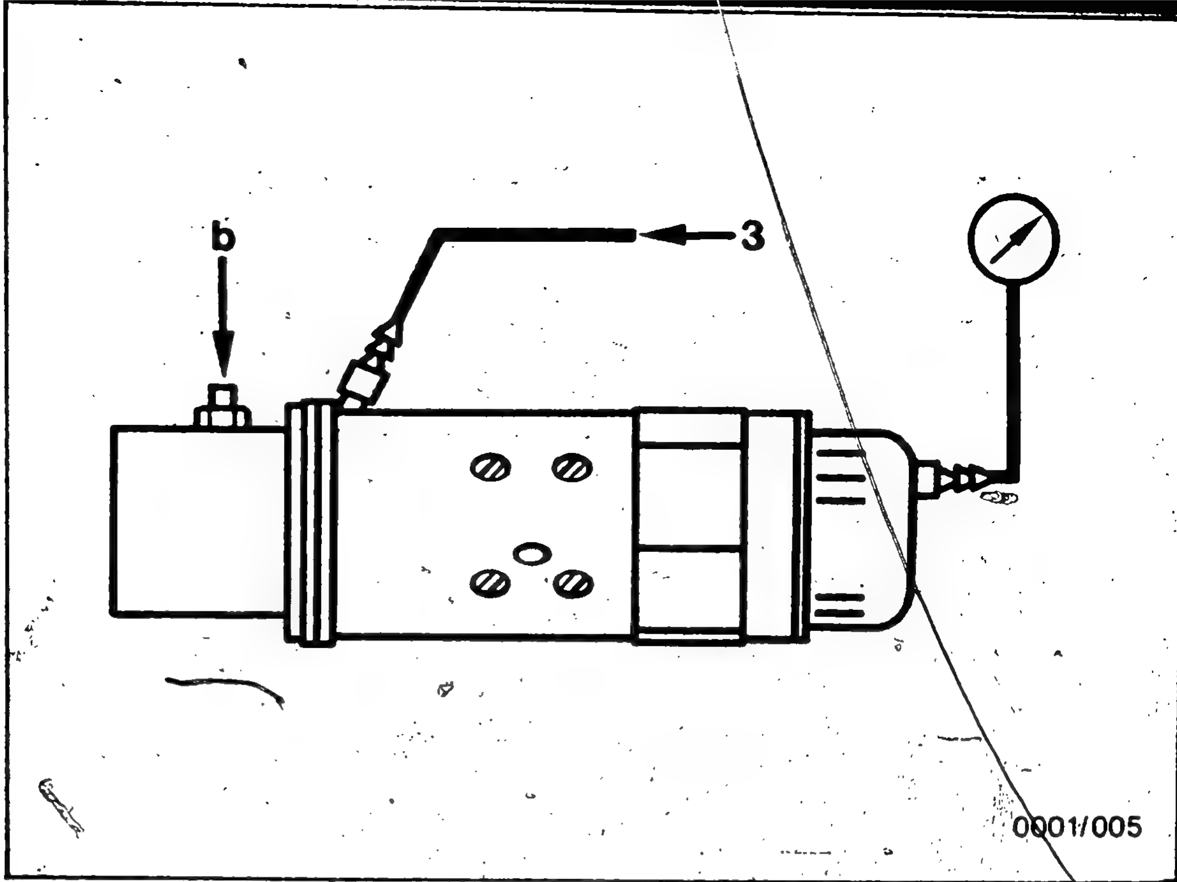
F 1



a = open
3 = Compressed air

4.2.2 Starting motor with intermediate transmission
Mount the covering cap together with seal ring on the drive side. The oil drain hole in the transmission housing and the tube in the covering cap remain open. Feed in compressed air (o.5 bar) and check the pressure drop according to para. 4.2.1 (See illustration).

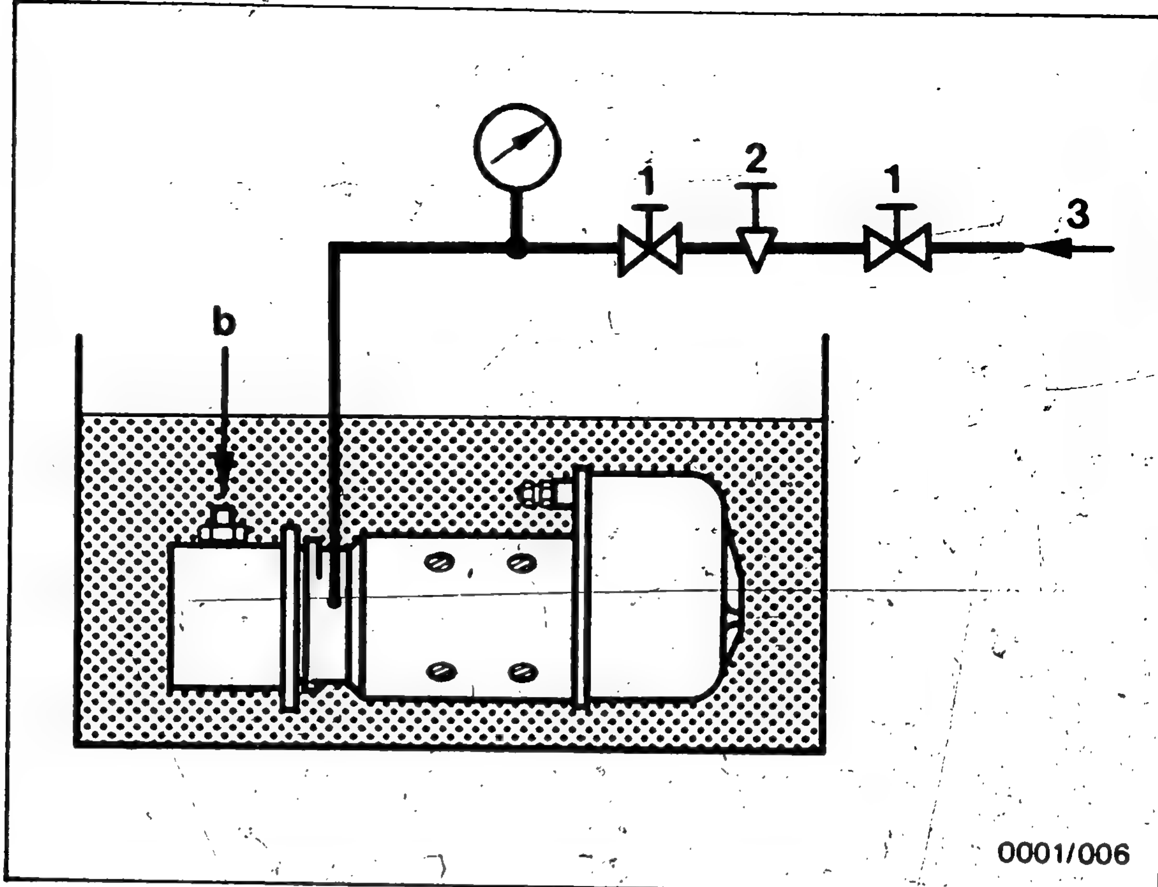
J 2



b = closed
3 = Compressed air

Close off the fitting in the covering cap and feed in compressed air (0.5 bar) via the oil drain hole (test connection) in the transmission and stator frame according to the above illustration and check the pressure drop as before.

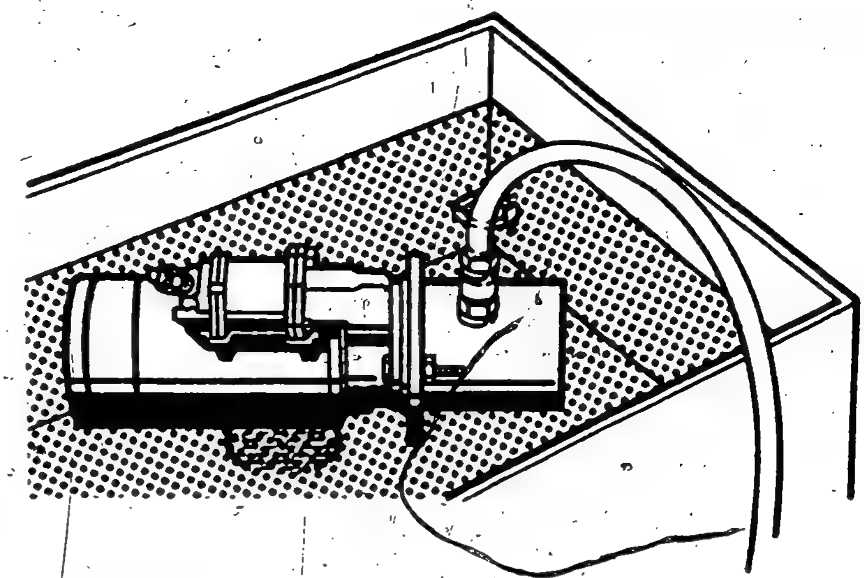
F 3



1 = Shut-off valve
2 = Pressure regulator
3 = Compressed air
4 = Seal the covering cap with seal ring
b = closed

4.2.3 In the case of a greater pressure drop than that specified in para. 4.2.1, open the shut-off valve and feed in compressed air up to 1.5 bar via the pressure regulator. Do not shut off the compressed air supply. Air bubbles given off when the motor is immersed in an oil or water berth serve to locate places which are not sealed. (See illustration).
Reseal the starting motor and repeat the tests.

I 4

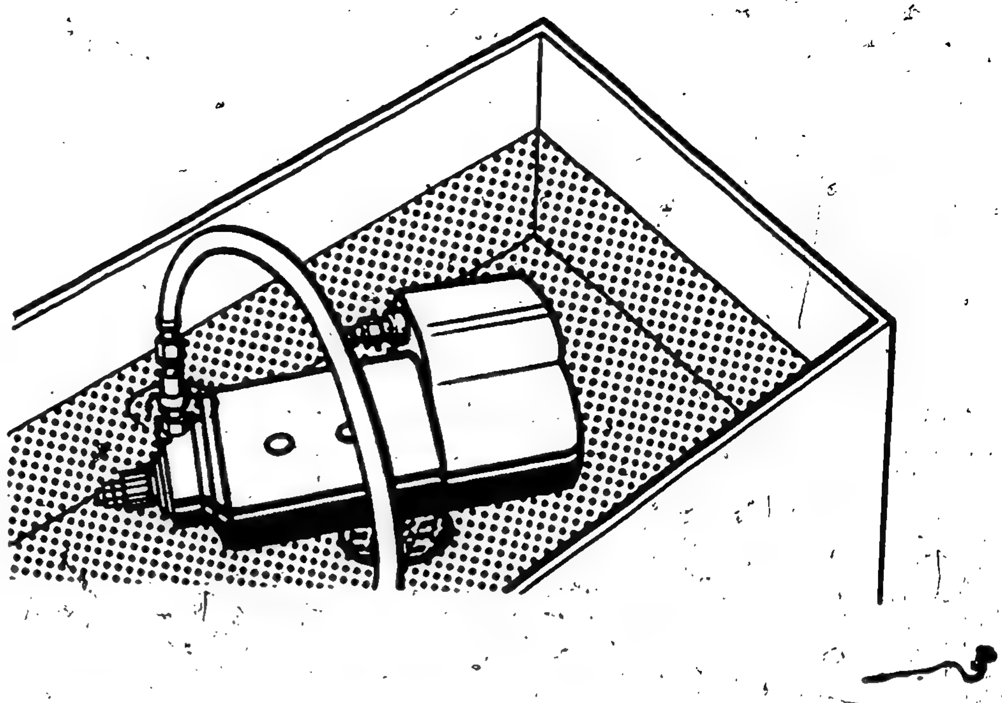


0001/007

5. Testing immersible (watertight) starting motors

5.1 For this test starting motors 0 001 2.. and 0 001 3. (flange mounting) with their corresponding covering caps and seal rings must be closed on the pinion side. (See illustration).
An intermediate ring is required for starting motor 0 001 2.. .

+5



0001/008

With starting motors 0 001 4..
0 001 5..
0 001 6.. the test fitting is screwed into the oil hole in the drive-end shield (See illustration).

After the test, the openings for the test connection must be carefully resealed and closed.

5.2 Connect compressed air to the test connection

Connect compressed air to the test connection. Test pressure: generally 0.2 bar, for special types pressure is specified. Completely immerse the starting motor in water.

Duration of test: 30 secs: for special types test duration is specified.

There must be no air bubbles.

F 6

New Product

Intermediate-transmission starting motor with epicycloidal gear train and permanent excitation

0 001 108 .. DW 12 V 1.1 kW

From the middle of 1982 Bosch will be delivering a newly developed permanently excited starting motor with epicycloidal gear train, type DW.

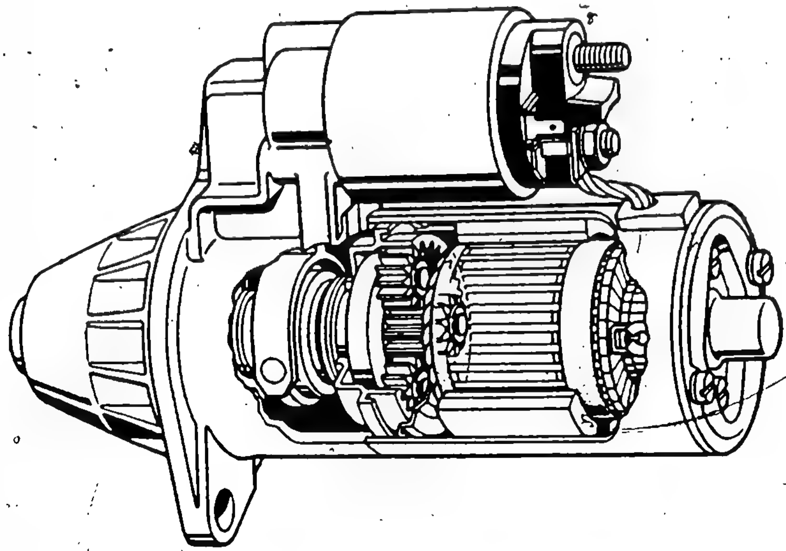
The main feature of the new starting motor is a saving in weight of approx. 40% compared with the traditional type, but with the same output (3.6 kg compared to 6.3 kg).

Like the traditional starting motor, it has a co-axial construction form due to the use of an epicycloidal gear train. No problems will therefore be incurred in fitting.

On the drive-end-bearing housing end a plastic fork lever with plastic bearing block has been used as with starting motors 0 001 211 5.. and 0 001 317.. .

The plastic brush-holder plate of starting motors 0 001 211 5.. and 0 001 317.. has been used on the commutator end shield.

The epicycloidal gear train on the axle of which is placed the pinion, consists of a hollow wheel and 3 sets of toothed gear in needle bushings. The toothed gear mesh with the gear teeth on the armature shaft.



BOSCH

Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung

F 7

F7

In the thin-walled stator frame permanent magnets are held firm with clamps.

On account of its special construction, the new DW starting motor is more susceptible to shock, movement and pressure than the previous designs. For this reason it should only be fitted on the flange (not on the stator frame).

The first starting motors of this type will be delivered to Audi and Mercedes-Benz.

INTERMEDIATE-TRANSMISSION STARTING MOTOR WITH EPICYCLOIDAL GEAR TRAIN AND PERMANENT-MAGNET EXCITATION.

VDT-I-001/131 En
4.1982

0 001 108 .. DW 12 V 1.1 kW

The newly developed type of starting motor with epicycloidal intermediate transmission and permanent-magnet excitation is being introduced as original equipment in 1982 (see Technical Bulletin "New product" VDT-I-001/1 for information on the starting motor).

First application: AUDI 100, AUDI 200 — 2.2 l, 5-cyl. engine

It should be noted that in comparison with the previous starting motor, the DW starting motor is, because of its construction, sensitive to impact, shock and pressure and may only be clamped by its flange when testing.

Until further notice, please send in all complaint starting motors of the new type unopened together with the usual warranty documents and stating the reason for the complaint.

From inside Germany to:

ROBERT BOSCH GMBH
Abteilung K9/VAK 2
Robert Bosch-Straße
7141 Schwieberdingen

From outside Germany through RG/AV to:

ROBERT BOSCH GMBH
Abteilung KH/LAV
Auf der Breit 4
D 7500 Karlsruhe 41
zur Weiterleitung an K9/VAK 2

The intermediate-transmission starting motor (Part No.: 0 001 108 001/..002) can - insofar as it is not in stock - be replaced by the after-sales service by the previous starting motor version 0 001 311 140.

In case of inquiries, please contact your local representative.

I9

STARTING MOTORS VDT-I-001/138 En

0 001 108 ... DW 12V (1.1 kW) 1.4 kW 10.84

0 001 110 ... DW 12V 1.7 kW

with externally mounted intermediate shaft

In order to prevent damage to the stationary ring gear, the armature, and the cover disc, the intermediate shaft must be supported on a suitable flanged bearing every time a test is made on externally-mounted DW starting motors.

Please direct questions and comments concerning the contents to our authorized representative in your country.

1	Technical Bulletin	

BOSCH

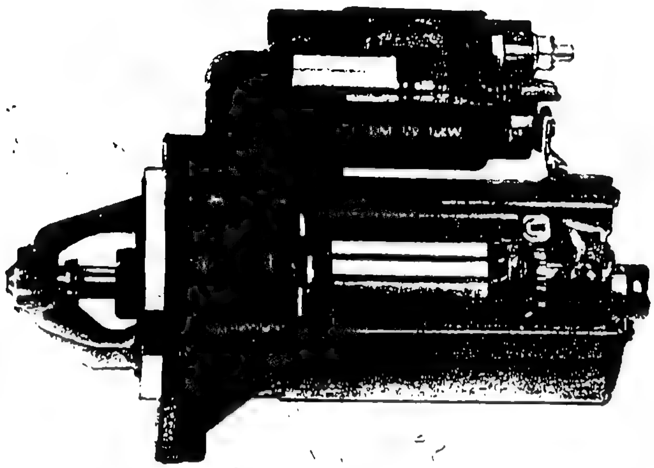
F10

New Product

Register 00...12
File Identity VDT-I-001/4 En
7. 1986

PERMANENTLY EXCITED STARTING MOTORS

Type 0001 112.., ..113 .., ..114 (DM)



As of mid-1986 Bosch is for the first time supplying a newly developed starting motor Type DM in the power range 0.8 ... 1.0 kW with direct drive and permanent excitation.

The meshing system of the starting motor is of identical design to that of starting motors 0 001 108.. and 0 001 110.. (Type DW).

Its main features are its small size and a reduction in weight of approx. 15% as compared with conventional starting motors of the same power (Type EF).

F11

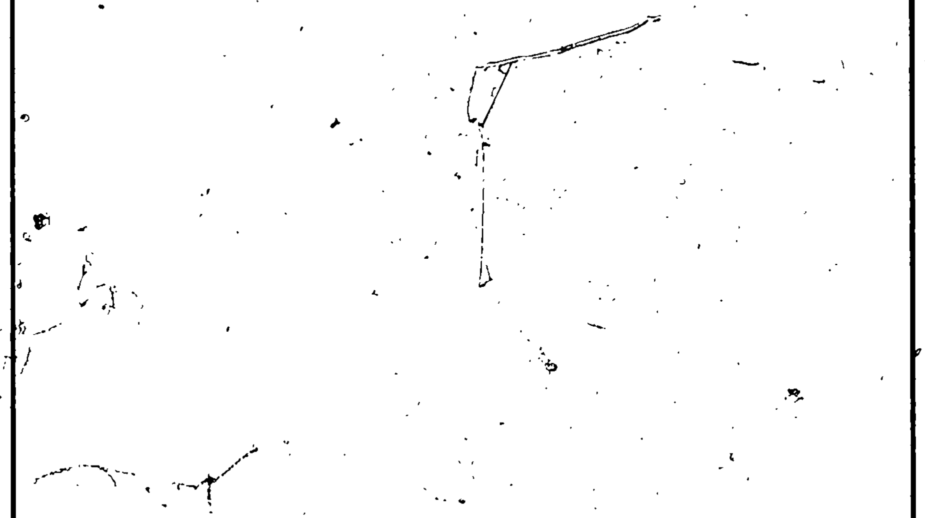
FM

As in DW starting motors, the permanent magnets are held by clamps in the stator frame.

Like the DW starting motor, the new DM starting motor is, due to its construction, sensitive to pressure and impact. It may therefore be clamped only by its flange (not by the stator frame).

On DM starting motors (0.9 and 1.0 kW) the leading edges of the permanent magnets have been provided with flux-concentrating pieces in order to ensure an optimum characteristic.

An intermediate bearing has been additionally installed on the DM starting motor (1.0 kW).



Published by:

Robert Bosch GmbH
Division KH
After-Sales Service Department
for Training and Technology (KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country

REPLACEMENT OF CARBON BRUSHES, EXCITATION WINDINGS AND BRUSH HOLDER

for starting motors with tubular brush holder

0 001	208 5..	EF	12 V	0.85 kW
	208 7..	EF	12 V	0.9 kW
	211 5..	EF	12 V	0.8 kW
	317 0..	GF	12 V	1.7 kW

Owing to design modifications to the brush holders and excitation-winding connections the following should be noted when carrying out repairs:

1. Replacing the carbon brushes

Remove the old welded-on carbon brushes with connecting cables (shunts). New replacement carbon brushes are supplied with welded-on U-shaped terminals on the shunts (Fig. 1). These U-shaped terminals are plugged onto the connecting bars on the brush holder and are soldered on (Fig. 2).

See service-part microfiches for the service-part numbers of the carbon-brush sets.

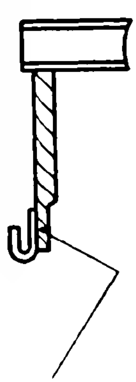


Fig. 1

Replacement carbon brush with welded-on U-shaped terminal

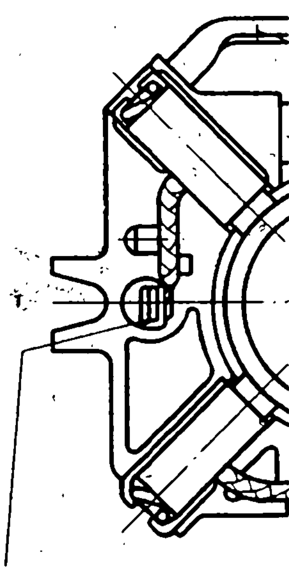


Fig.

Slip the U-shaped terminal on here and solder in position

Geschäftsbereich KH Kundendienst. Kfz-Ausrüstung.

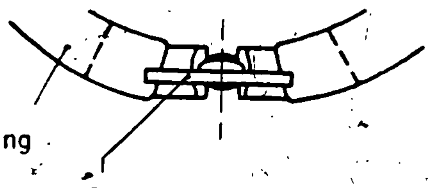
2. Replacing the excitation winding

2.1 Starting motors 0 001 208 7.. with copper excitation winding
0 001 317 0..

Cut off the connecting cable of the excitation winding at the welded connection to the positive brush joining bar. File off the remains of the wire on the joining bar. The replacement excitation winding has a 20 mm long bar welded onto the connecting cable for the brush holder (Fig. 3). This bar should be soldered to the positive brush joining bar at the same place.

Note:
In order to prevent a short circuit to ground ensure that the connecting cable of the new excitation winding does not stand proud of the positive brush joining bar.

Fig. 3



2.2 Starting motors 0 001 208 5.. with aluminium excitation winding
0 001 211 5..

In the event of failure of the excitation winding or brush holder, both must be replaced together.

See service-part microfiches for service-part numbers.

3. Replacing the brush holders

3.1 Starting motors 0 001 208 7.. with copper excitation winding
0 001 317 0..

The replacement brush holder is supplied complete with carbon brushes and a mounting ring (for slipping onto commutator) (Fig. 4).

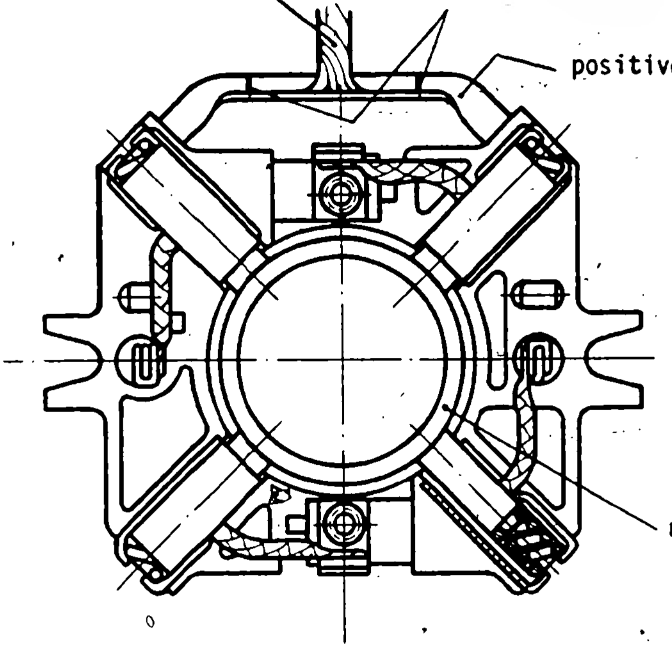
In order to mount the new brush holder, cut open the positive brush joining bar over a length of about 20 mm as shown in Fig. 4.
The part of the positive brush joining bar which remains on the excitation winding should be soldered to the new brush holder. When doing this, make sure that the connecting cable of the new excitation winding does not stand proud of the positive brush joining bar.

See service-part microfiches for service-part numbers.

Fig. 4 Connecting cable Excitation winding

cut open here when changing brush holder

positive brush joining bar



mounting ring

3.2 Starting motors 0 001 208 5.. with aluminium excitation winding
211 5..

In the case of starting motors with aluminium excitation winding it is not possible to make contact between excitation winding and brush holder, should the brush holder need replacing.

In the event of failure of the brush holder or excitation winding, both must be replaced together.

Please direct questions and comments concerning the contents to our authorized representative in your country.

Instigated by K9/VAK

Starting motor 0 001 211 206 – EF 12 V 0.85 kW with new drive-end-bearing housing for Ford passenger cars with 1.1 ... 1.6 l engines

As of FD 724 (April 1977) drive-end-bearing housing 1 005 822 280 is no longer available for starting motor 0 001 211 206.

It will be replaced by parts set 1 007 010 007 with a new drive-end-bearing housing 1 005 822 306, a rubber seal and a stop bushing. Instructions for inserting the rubber seal are specified in Technical Bulletin VDT-I-001/115. Drive stop 2 001 329 010 (Fig. 1) used to date for the starting-motor drive (item 23 on microfiche EE-..) should no longer be mounted in the new drive-end-bearing housing 1 005 822 306.

For this reason a stop bushing (Fig. 2) for the drive stop must be slipped over the armature shaft instead of the drive stop mounted to date. This stop bushing will in future be included with parts set 1 007 010 007.

To prevent contacting of the starting-motor drive in the drive-end-bearing housing the TX washer should be removed from starting-motor drive 2 006 209 321 or 1 006 209 437 prior to converting the starting motor to the stop bushing.

> Under no circumstances must the stop bushing be forgotten, otherwise the control lever will brush against the winding overhang of the armature.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

F16

F 16

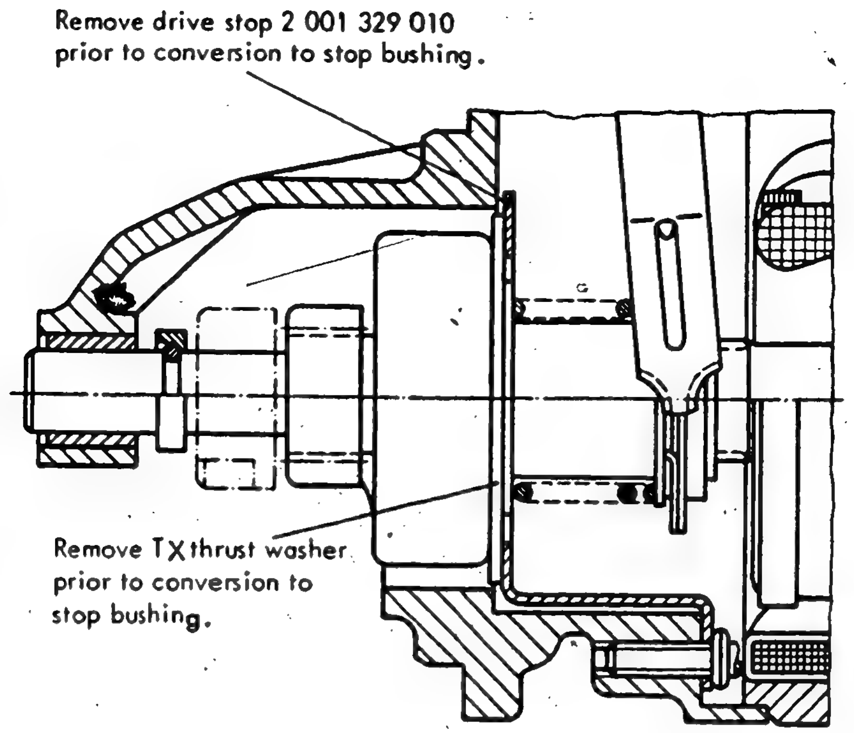


Fig. 1 Starting motor to date - 0 001 211 206 with drive-end-bearing housing 1 005 822 280 (changes to 0 001 211 228 after conversion of drive-end-bearing housing).

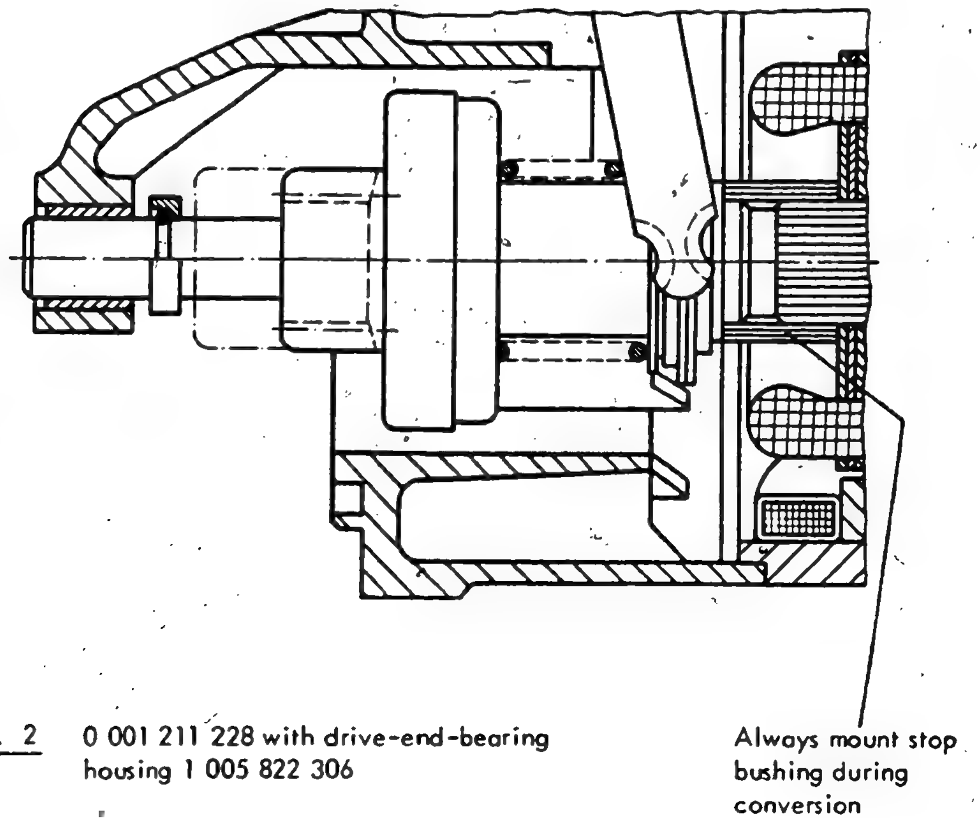


Fig. 2 0 001 211 228 with drive-end-bearing housing 1 005 822 306

F17

H27

G19

After-sales Service Instructions

Repairs

00

VDT-W-001/103 En
Suppl. 1
Ed. 1

Starting motors
Ignition-proofing for starting motors

0 001 212 208
311 042
311 127
314 025
314 032

BOSCH After-sales Service Automotive Equipment

This publication has been redesigned with the forthcoming change-over to microfilm in mind.

When a publication has been transferred to microfilm, the screen will be filled completely by a quarter of a printed publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference is constantly being made to a particular illustration.

Until the change-over to microfilm, we have slightly reduced the size of the print and of the illustrations.

Automotive Equipment - After-sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1

Published by: After-sales Service
Department for Training and Technology (KH/VSK)
Please direct questions and comments concerning the contents to our authorized representative in your country.

Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne
par Robert Bosch GmbH.
(2.80)

I .15

The starting motors listed are intended for export to the USA for gasoline-driven boat engines. The US Coast Guard regulations demand that the products of the electrical engine equipment be fitted with so-called "ignition-proofing." This is to make sure that no explosion can occur even when operated in a combustible atmosphere. This ignition-proofing in Bosch starting motors takes the form of the usual sealing of the electrical part with the intermediate bearing or drive-end-bearing housing and the commutator end shield.

When repair work is carried out please see that these parts are properly sealed off. During assembly the partitions between the stator frame, drive-end-bearing housing or intermediate bearing and the stator frame, commutator end shield should be coated with graphite sealing putty Kk1v3 (part no. 5 703 452 150 in 500 g tins). No other holes or openings must be made in the starting-motor housing, or be present upon fitting.

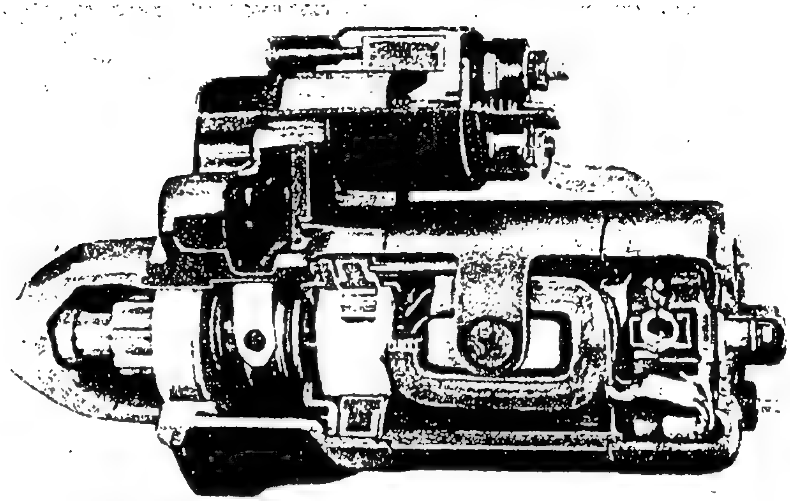
New product

00...12

INTERMEDIATE-TRANSMISSION STARTING MOTOR WITH PLANETARY-GEAR TRAIN AND ELECTRICAL EXCITATION 0 001 218 .. EV 12 V 2.2 kW

VDT-I-001/3 En

5.1984



Since the beginning of 1983 Bosch has been supplying a newly developed, electrically excited starting motor 0 001 218 .. (EV ..) with planetary gear train (similar in design to starting motors 0 001 108../110.., DW..). This model of starting motor is increasingly replacing the previous starting motors 0 001 362.. in passenger-car diesel engines of various vehicle manufacturers (e.g. DB, BMW, Citroen etc).

1	Technical Bulletin	→

BOSCH Geschäftsbereich KH, Kundendienst Kraftfahrzeug Ausrüstung.

F 21

F21

Like the conventional starting motors, starting motors 0 001 218 .. have a coaxial construction.

The size has been reduced through the use of a planetary-gear train. In comparison with the previously used starting-motor types of similar power output there are weight savings of about 40% (approx. 6.0 kg as opposed to 10.1 kg).

The planetary-gear train has a ratio of 3.3 : 1

On the drive-end-bearing housing side there is a plastic fork lever with plastic bearing block; on the commutator end there is a plastic brush-holder plate.

Please direct questions and comments concerning the contents to our authorized representative in your country.

2		←

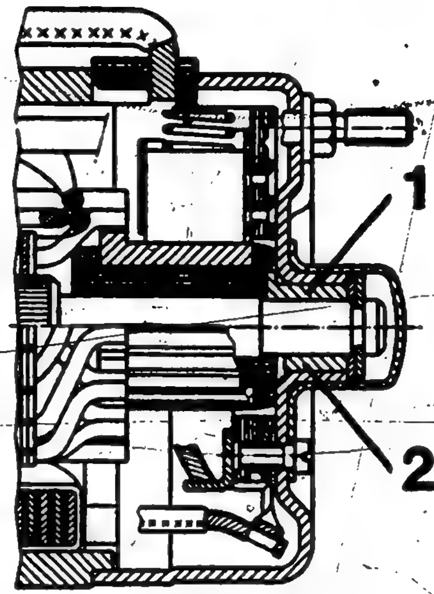
F22

STARTING MOTORS 0 001 218 .. - EV 12 V 2.2 kW

Modifications to commutator end shield

VDT-I-001/139 En

9.1985



1 = New version:
Sintered bushing with collar. Commutator runs against collar of sintered bushing.

2 = Previous version:
Sintered bushing without collar. Commutator runs against commutator end shield.

On intermediate-transmission starting motor 0 001 218 .., as of FD 544/545 a sintered bushing with collar is installed in the commutator end shield. The thrust collar of the commutator on the armature has also been changed (see picture).

F 23

BOSCH
Geschäftsbereich KH. Kundendienst Kraftfahrzeug Ausrüstung.

Note the following when repairing these starting motors of an earlier version:

- If continuing to use the previous armature, install the sintered bushing without collar in the commutator end shield.
- If using a new armature with modified thrust collar, install either the old or new version of sintered bushing in the commutator end shield.

The part number of the service-part armature is retained despite the modification.

If ordering the commutator end shield from the previous service-parts list, you will receive a parts set consisting of the commutator end shield without sintered bushing but with sintered bushings of old and new versions loosely enclosed. Depending on the modification status of the armature used (thrust collar), install the appropriate sintered bushing in the commutator end shield.

Both sintered bushings are also available separately:

Bushing without collar (old version) - 9 001 140 347

Bushing with collar (new version) - 1 000 322 005

The service-parts microcards are being modified accordingly.

Please direct questions and comments concerning the contents to our authorized representative in your country.

F 24

CHECKING OF STARTING MOTORS

0 001 35.., 0 001 36..,
0 001 40.., 0 001 41..,
0 001 42..

Starting motors with part no. 0 001 35.. and 0 001 36.. of size J and starting motors with part no. 0 001 40.., 0 001 41.. and 0 001 42.. of size K are basically maintenance-free, i.e. relubrication and adjustment operations are not envisaged during the normal service life.

In special cases such as:

- Emergency vehicles
- Season-related machinery, e.g. combine-harvesters, snow-clearing vehicles etc.
- Standby power units
- Military vehicles
- Transport companies (long and short distance)

it is advisable after a certain period of operation to subject the starting motors on such machinery/vehicles to a preventive check, particularly in the case of tough service conditions such as dusty environment, frequent starting, heavy vibration.

The advantages of a preventive check are obvious:

- No risk of failure.
- Operational readiness is guaranteed.
- The costs are clearly lower than if a defective starting motor had to be repaired.

During the check, the starting motor is dismantled, cleaned, assessed and, if necessary, repaired and tested in accordance with the repair instruction manual.

This virtually rules out the risk of failure. This service should be offered to those customers whose vehicles/engines must always be ready for duty.

Please direct questions and comments concerning the contents to our authorized representative in your country.

BOSCH Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

GF 12 V 1.1 kW (1.5 HP)
0 001 311 103, ..105, .. 106 for Volvo passenger cars
108, .. 109 for Saab passenger cars
Alteration to starting motor drive

VDT-I-001/114 B
4. 1976

Owing to meshing difficulties with the above-mentioned starting motors, drive 1 006 209 410 has been replaced by drive 1 006 209 404 as from FD 623 (March 1976). The gear tooth chamfer has thereby been changed from 45° to 35°.

As from now only drive 1 006 209 404 will be supplied.

In the event of meshing difficulties drive 1 006 209 404 must be fitted, and the ring gear must be checked.

Warranty procedure

Starting motors on which claims are made as a result of meshing difficulties and damaged gear teeth may be repaired free of charge within the warranty period. In case of inquiry, please contact your authorized representative.

F 26

BOSCH

Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

0 001 311 105...106 - GF (R) 12 V 1.1 HP
Starting motor for Volvo B 27 - 2.6 l

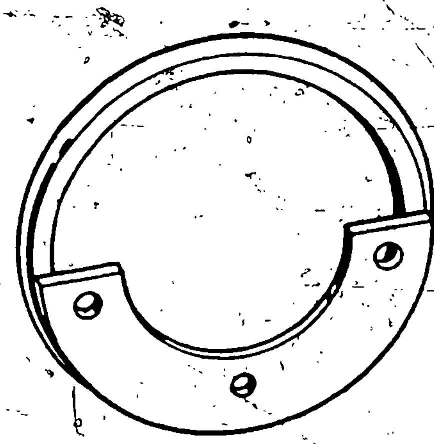
Clamping possibility on the starting-motor test benches

EFAL 90.., EFAL 140.., EFAW 275..

A new clamping flange must be used for clamping the above-mentioned starting motor.

The starting motor has a pilot diameter of 82.5 mm; the diameter of the imaginary circle through the centers of the holes is 114 mm. The short design of the drive end shield renders an additional recess in the clamping flange necessary.

The clamping flange with register dia. 82 mm can be ordered under part number 1 685 720 189.



Clamping flange, register dia. 82 mm
Part Number 1 685 720 189

BOSCH
Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

F27

0 001 314 002 - GF 12 V 1.4 DIN HP
0 001 362 028 and ..030 - JF 12 V 2,5 DIN HP

Starting motors with Helicoil thread in
Daimler-Benz vehicles

As from April/May 1975 (FD's 524 and 525) Helicoil thread inserts will no longer be fitted in the drive end shields of the types of starting motor mentioned above, and in the case of JF starting motors they will no longer be fitted either in the drive end shield or in the commutator end shield. To compensate for this the fastening flange on the drive end shields will be increased in thickness from 16 mm to 18 mm.

Should a starting motor with Helicoil insert be replaced by one without Helicoil, the following points are to be observed:

1. Starting motor 0 001 314 002 for 4- and 6-cylinder vehicles, gasoline

   The through bolt (with nut) is fitted as before.

   The spring lock washer and plain washer are no longer fitted on the other fastening screw (thread in the AL flange). A corrugated spring washer 2 916 063 015 (1 mm thick) should be used instead.

2. Starting motor 0 001 314 002 for 8-cylinder vehicles, gasoline

   The through bolt (with nut) is fitted as before.

   The other fastening screw M 12 x 75 is replaced by a longer screw M 12 x 80 as per DIN 931 quality 8.8 and fitted together with a plain washer (2.5 mm thick) as well as the already present corrugated spring washer.

   If in the 3.5 and 4.5 ltr. models with automatic transmission shims are fitted between the contact surface of the starting motor and the crankshaft housing, then these same shims should be re-fitted should a new starting motor be installed. They are NOT to be replaced by the thicker end flange.

3. Starting motor 0 001 362 030 for 4- and 5-cylinder vehicles, Diesel

   The spring lock washer and the plain washer are no longer fitted on the 2 fastening screws for the drive end shield. In their place a corrugated spring washer 2 916 063 015 (1 mm thick) must be used. The fastening screws on the commutator side, previously M 6 x 14, must be exchanged for M 6 x 16 as per DIN 933, quality 5.6.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

4. Starting motor 0 001 362 028 for small motor trucks, Unimog

The fastening screws on the commutator side, previously M 6 x 14, must be exchanged for M 6 x 16 as per DIN 933, quality 5.6.

Screws and plain washer with no part number given can be obtained through ordinary commercial channels. The corrugated spring washer 2 916 063 015 is available through the usual channels.

Tightening torques

Screws M 12 : max. 65 N.m (6.5 mkgf)

Screws M 6 : max. 7.5 N.m (0.75 mkgf)

In case of inquiry, please contact your authorized representative.

Published by:
Trade Division K 1
Dept. K 1/VAK 6

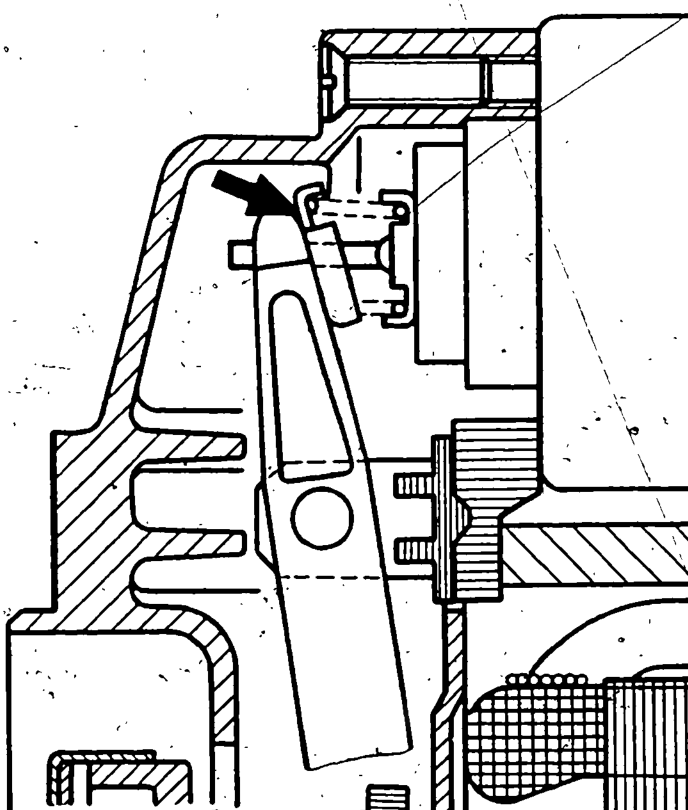
9 1

G1

Starting motors 0 001 312 108
0 001 317 ...

2.1982

When fitting the solenoid switch 0 331 303 .. to starting motors 0 001 312 108 and 0 001 317 .. attention should be paid to the correct position of the spring seat. The spring seat must be fitted with the opening at the top (see Fig. arrow).
Incorrect fitting can lead to difficulties when the pinion meshes and demeshes.



After-sales Service Instructions

Repair

00

VDT-W-001/103 En
Ed. 2
supersedes VDT-WJE 501/10
512/4
512/7
512/8
512/9
512/10

Starting motors

0 001 000 .. – 0 001 160 ..
inertia-drive starting motors
0 001 207 .. – 0 001 366 ..
pre-engaged-drive starting motors

This publication has been redesigned with the forthcoming change-over to microfilm in mind.

When a publication has been transferred to microfilm, the screen will be filled completely by a quarter of a printed publication page. For this reason, it is unavoidable that illustrations are repeated in the case of longer texts in which reference is constantly being made to a particular illustration.

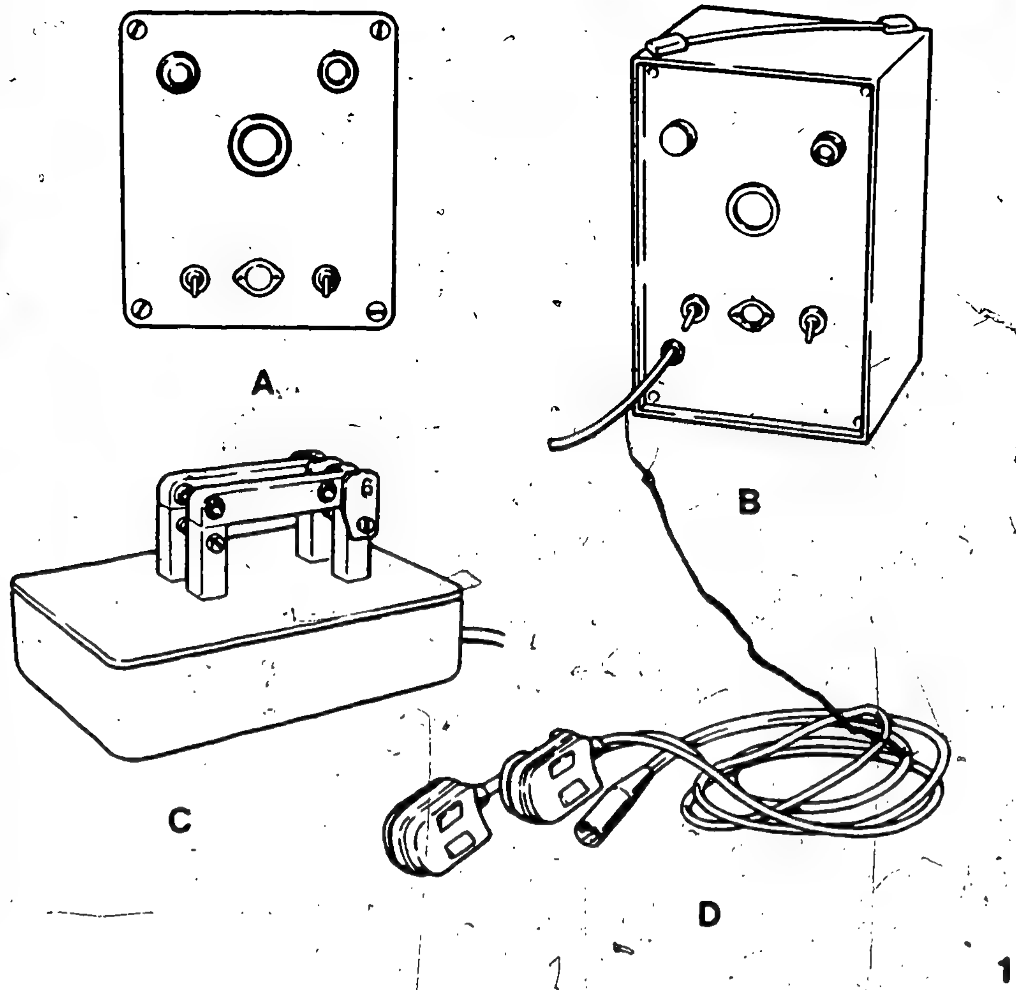
Until the change-over to microfilm, we have slightly reduced the size of the print and of the illustrations.

Table of contents

Automotive Equipment – After-sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1

Published by: After-Sales Service
Department for Training and Technology (KH/VSK)
Please direct questions and comments concerning the contents to our authorized representative in your country.

Printed in the Federal Republic of Germany. Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.
(10.1979)



1. Testers

1.1 Interturn-short-circuit tester
for armatures and windings

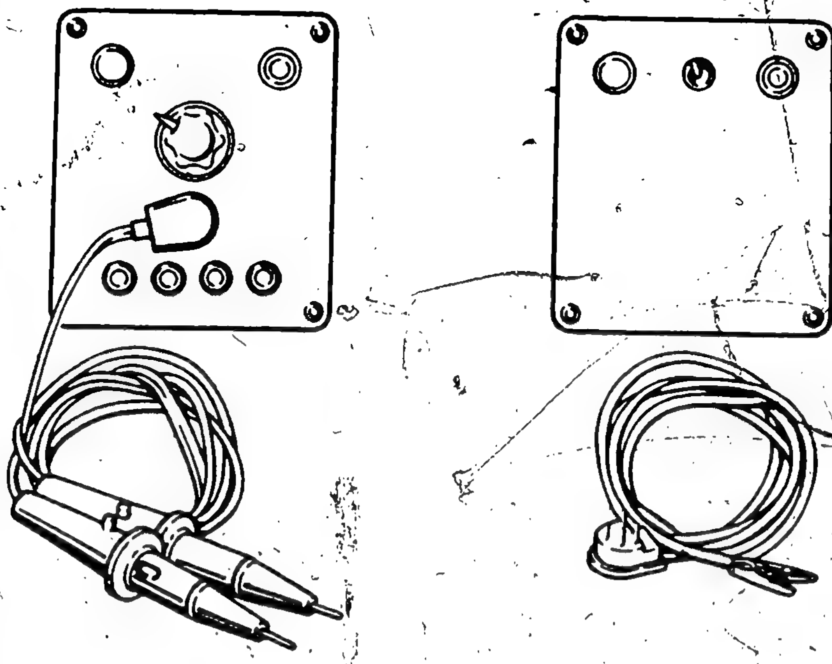
A = EFAW 90 as built-in panel 0 681 169 020

B = EFAW 95 in box-shaped case 0 681 169 034

C = Coil-testing yoke
EFAW 97 0 681 169 022

D = 2-part test probe
EFAW 90/10 1 684 210 002

95



A B

2

Short circuit to chassis and continuity testing

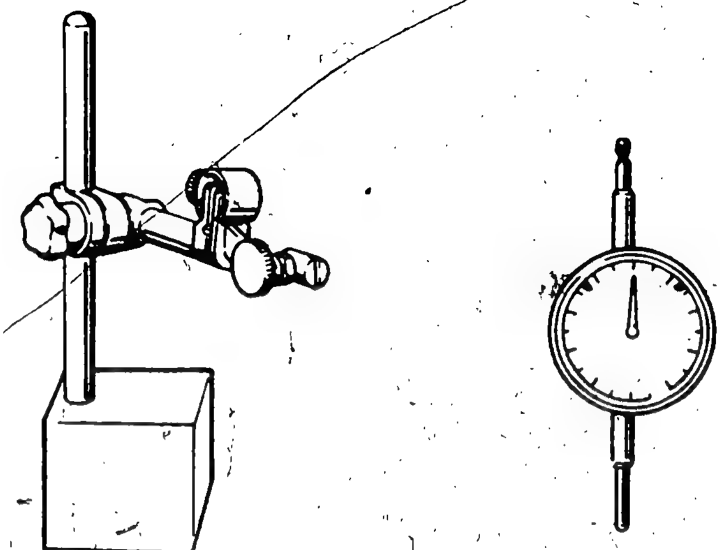
A = 1.2 Test panel
EFAW 81 0 681 169 013

Test leads with test prods
EFAW 81/6 1 684 423 009

B = 1.3 Transformer panel
EFAW 82 0 681 169 014

G6

W-001/103
Seite 3



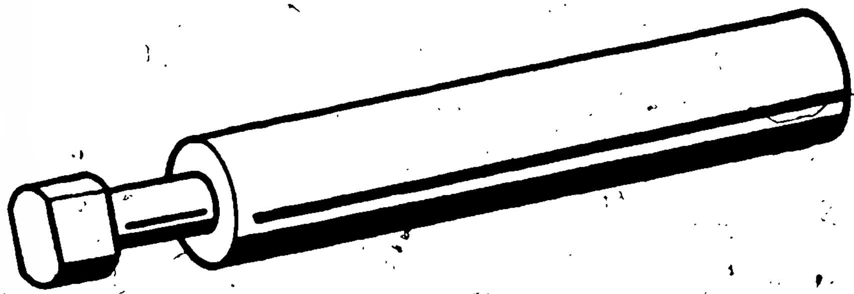
A B

3

Eccentricity of commutator or armature

A = 1.4 Magnetic instrument stand
T-M1 4 851 601 124
(previously EWM S1 B1 0 601 980 001)
or commercially available

B = 1.5 Dial indicator
EFAW 7 1 687 233 011

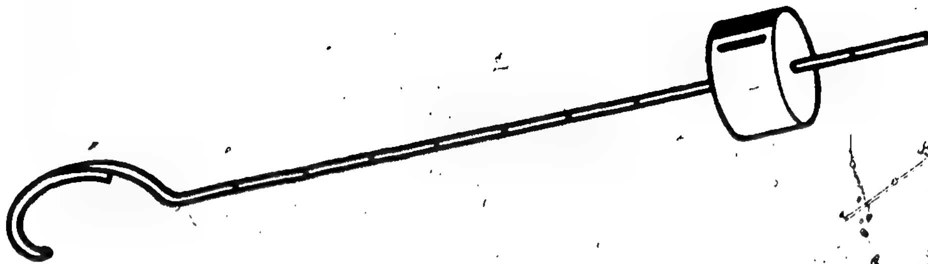


4

1.6 Plug gauges

KDAL 5024	for Audi 80 (8.72 →)	Fail gauge with 12.15 mm dia.
KDAL 5480 (previously EF 3565A 1 687 973 000)	for VW (→ 8.66)	Fail gauge with 12.65 mm dia.
KDAL 5475 (previously EFAL 128 1 687 969 007)	for CB and DG starting motors and VW (9.66 →)	Pass gauge for bushings ID 11.0 mm

9 8



5

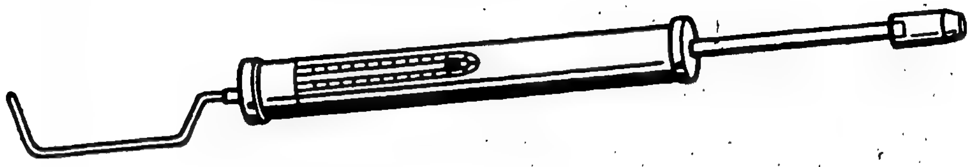
For armature braking torque and overrunning torque

1.7 Torquemeter

KDAL 5482 0.04 ... 0.12 Nm
(0.4 ... 1.2 cmkg)
(previously EFAL 27 0 681 400 002)

KDAL 5485 0.15 ... 0.8 Nm
(1.5 ... 8 cmkg)
(previously EFAL 26 0 681 400 001)

9 9



6

For measuring spring pressures of carbon brushes and relay springs

1.8 Spring scale

KDAW 9991 2 ... 12 N
(0.2 ... 1.2 kp)
(previously EF 1244 0 681 400 004)

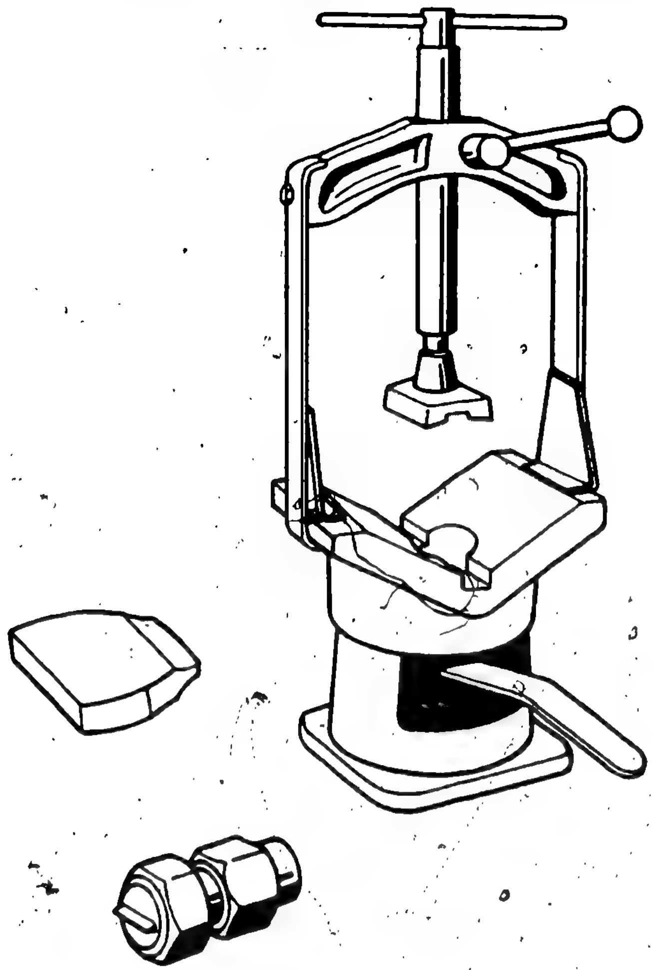
KDAW 9993 5 ... 20 N
(0.5 ... 2 kp)
(previously EF 1244 B 0 681 400 006)

KDAW 9992 15 ... 50 N
(1.5 ... 5 kp)
(previously EF 1244 A 0 681 400 005)

910

G10

Seite 4



7

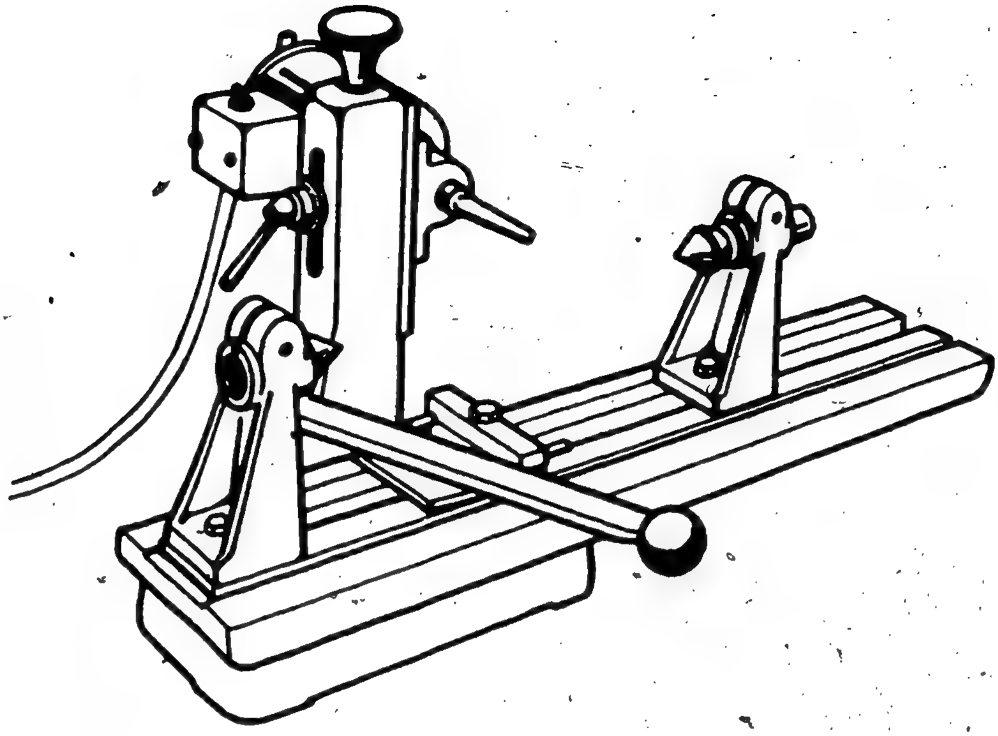
2. Tools

2.1 Clamping support with pole shoe screwdriver

KDAW 9999
(previously EFAW 9 0 681 269 007)

For clamping during disassembly and assembly of starting motors, loosening and tightening of pole shoe screws.

9/11

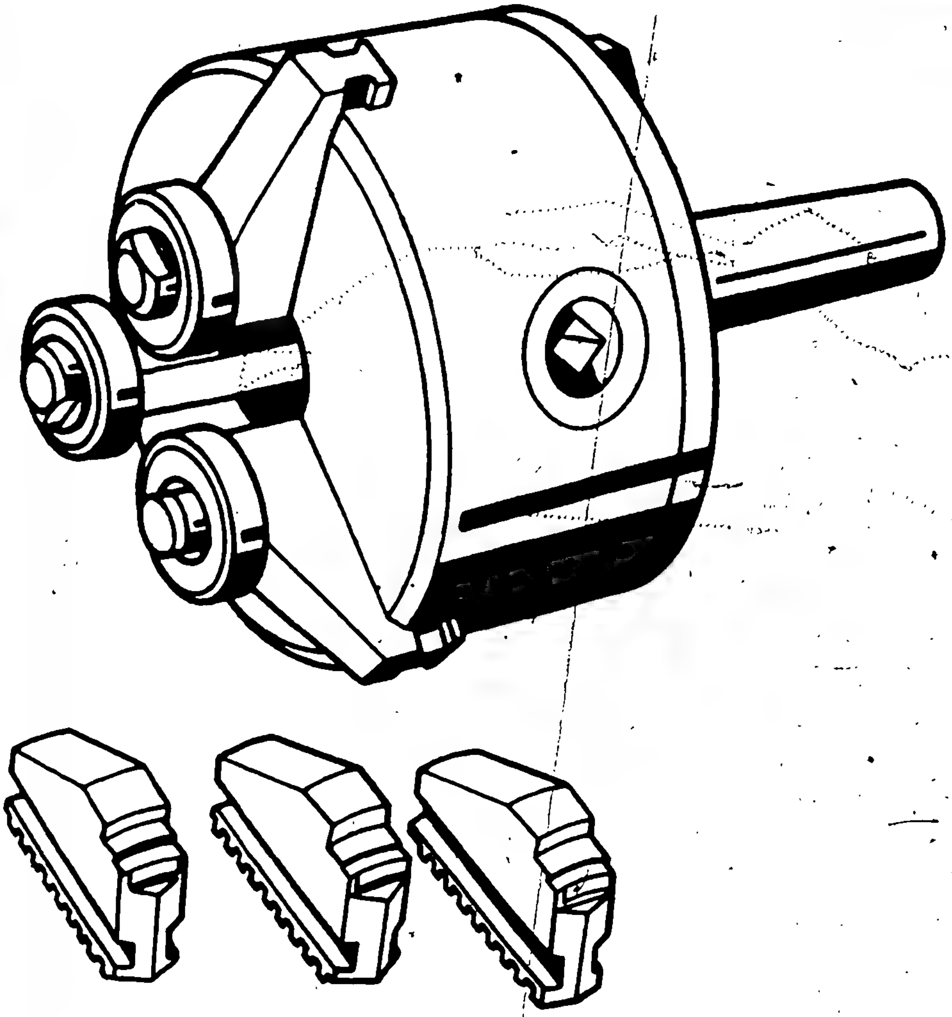


8

2.2 Undercutting saw

KDAW 9998
(previously EFAW 10 0 681 269 008)

for sawing out segment insulation.



9

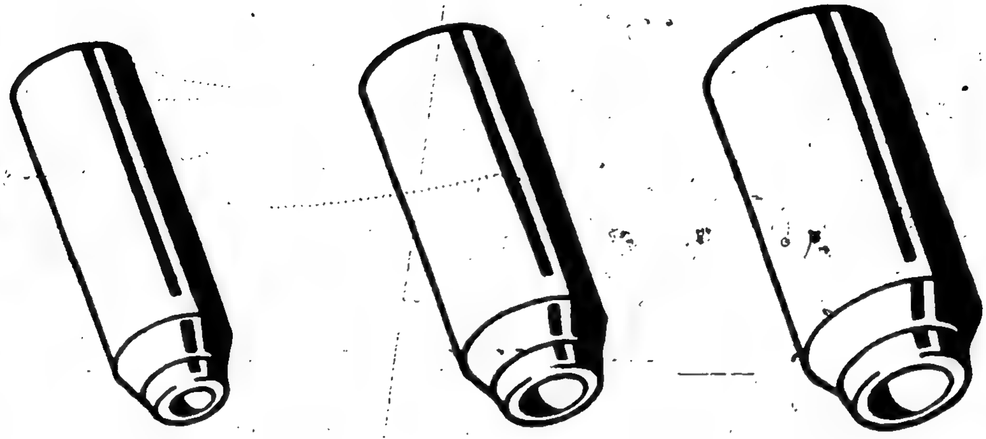
2.3 Tailstock chuck

KDAW 9987 with standard cone 2. Clamping dia. 5–45 mm
(previously EFAW 75 A 0 681 269 013)

KDAW 9990 with standard cone 3. Clamping dia. 5–45 mm
(previously EFAW 75 B 0 681 269 014)

For supporting armatures at commutator end when turning down commutators

S 13



10

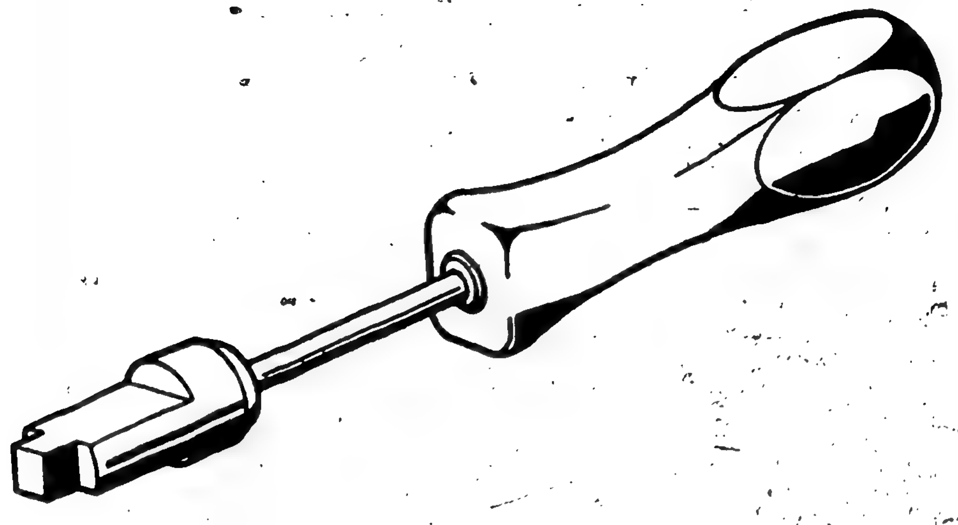
2.4 Set of tools (mounting sleeves)

For removal from or mounting on armature shaft of stop and retainer ring (for outward clamping retainer rings)

KDAL 5027	for EF starting motors (VW)	for armature shaft dia. 11.0 mm
KDAL 5028	for DD – DF – DG, EF, GE – GF and JF starting motors	for armature shaft dia. 12.0 mm
KDAL 5029	for GE and JD – JF starting motors	for armature shaft dia. 14.2 mm

S 14

W-001/103
Seite 5



11

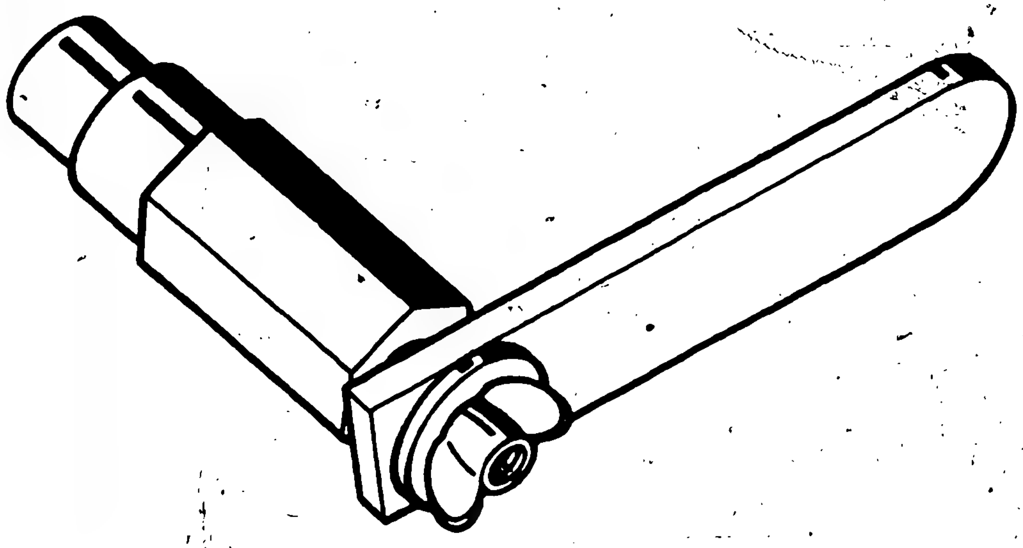
2.5 Assembly tool

For replacing carbon brushes in the case of JF starting motors

After pressing down the helical compression springs the retaining lugs of the brush holder are bent in accordance with the tool profile.

S 15

D 23



12

2.6 Extractor

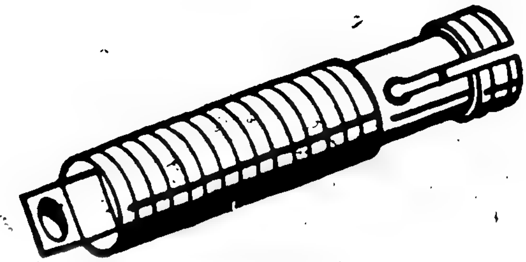
KDEP 1056/10 (basic part)
(previously KDAL 5493 or EFAL 17   0 681 300 003)

For extracting the bushing from the commutator end shield and armature bearing in motor.

Spring collets (order separately since not part of scope of delivery):

12.0 ... 12.5 dia.	KDA	5493/0/3
11 dia.		5493/0/11
10 dia.		5493/0/7
14.3 dia.		5493/0/8
15.1 dia.		5493/0/10

G16



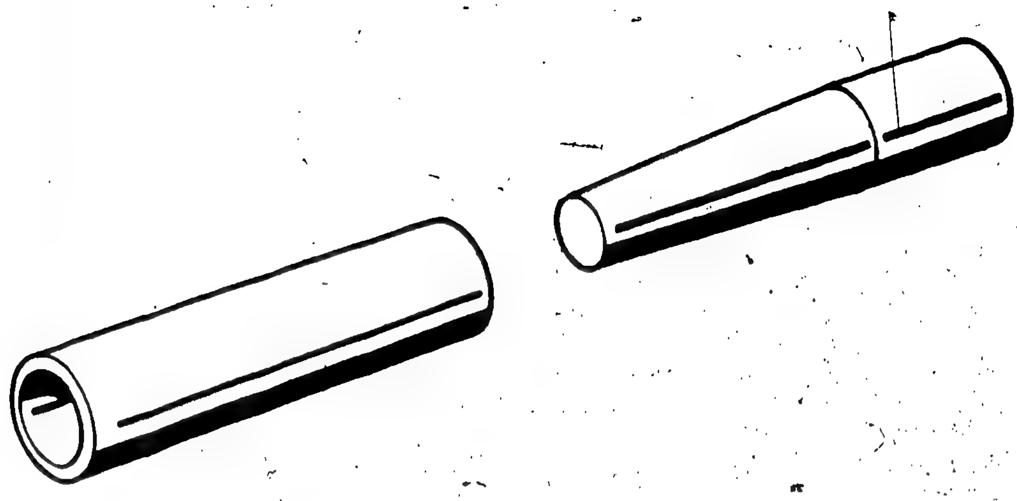
13

2.7 Spring collets
(accessories for KDEP 1056)

For extracting the self-lubricating bushings from starting-motor armature end supports in motor and commutator end shield

KDAL 5493/0/3 (previously EFAL 1/3 1 687 965 031)	for CB, DG, EF, GF and JD starting motors Audi 80 (8.72 →) VW (→ 8.66)	for bushings ID 12.0 ... 12.5 mm
KDAL 5493/0/11 (previously EFAL 1/11 1 687 965 051)	for CB, DG and EF starting motors VW (9.66 →)	for bushings ID 11.0 mm
KDAL 5493/0/7 (previously EFAL 1/7 1 687 965 032)	for DD starting motors	for bushings ID 10.0 mm
KDAL 5493/0/8	for JB starting motors	for bushings ID 14.3 mm

G 17



14

2.8 Pressing-on tool

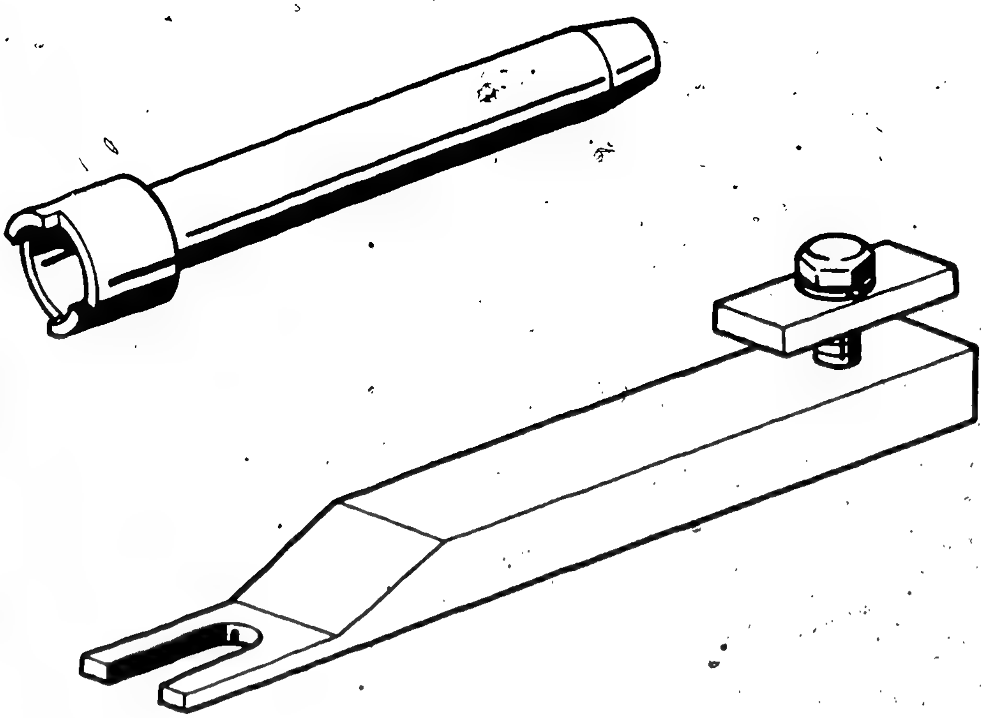
KDAL 5484 (previously EF 2722)

For pressing the retainer ring (inward clamping) onto the armature shaft of the VW starting motor (built prior to 1966).

G 18

6

Seite 6



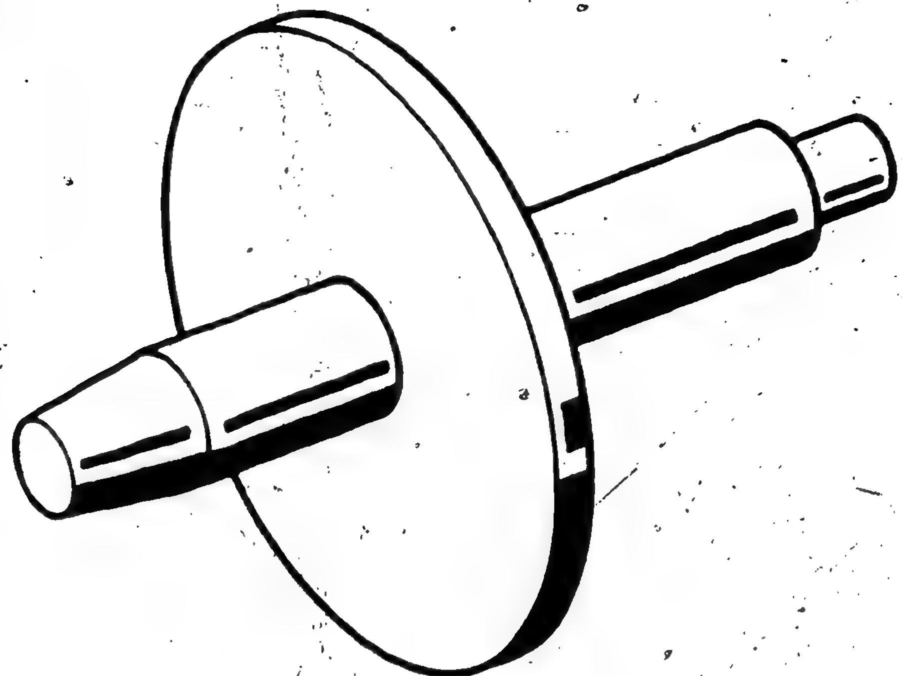
15

2.9 Caulking device VW up to 1966

KDAL 5487
(previously EF 2719 A 1 688 110 000)

For caulking the stop ring

G 19



16

2.10 Plate washer with mandrel

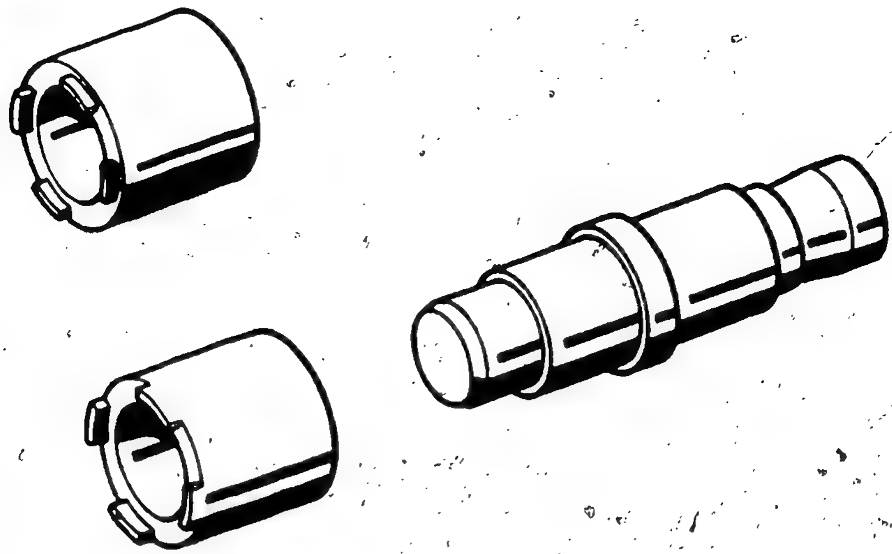
KDAL 5025 Audi 80 as of 1972, dia. 12 mm

KDAL 5486 VW up to 66, dia. 12.5 mm
(previously EF 2729 1 683 020 000)

Press-in mandrel for bushings

KDAL 5477, ID 11.0 mm
(previously EFAL 129 1 683 120 026 as of 66 VW)

For pressing bushing into starting-motor armature end support of motor.



-17

2.11 Caulking tool

KDAL 5488
(previously EFAL 146 1 687 931 002)

KDAL 5488/0/2
(previously EFAL 146/0/2 1 687 931 005)

KDAL 5488/0/3
(previously EFAL 146/0/3 1 687 931 006)

For caulking bushing with and without collar. JB-EB-GB

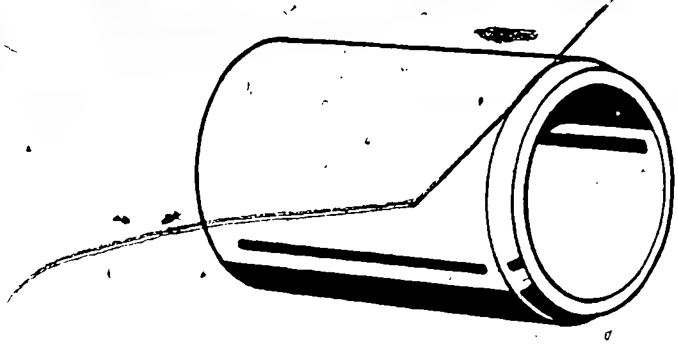
G 21

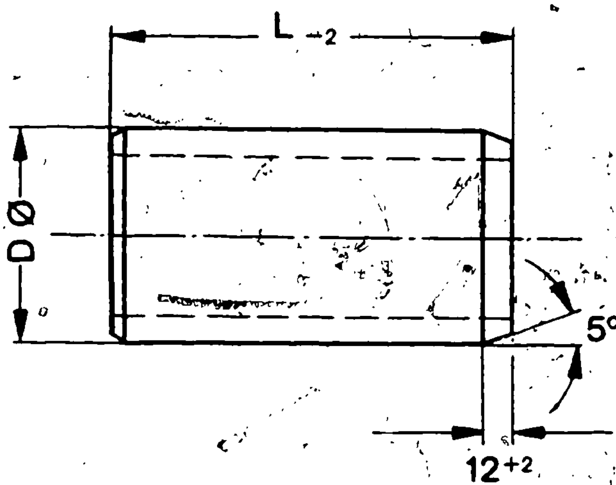
2.12 Driving-in mandrels for user manufacture

	D mm		L mm
CB 0.3 PS	42	−0.01 −0.06	60
DD	52.7	−0.01 −0.06	85
DF	52.7	−0.01 −0.06	85
DG	52.7	−0.11 −0.16	85
ED	60.8	−0.01 −0.06	100
EF	60.8	−0.01 −0.06	100
EB	60.8	−0.01 −0.06	100
GE	66.1	−0.01 −0.06	85
GF	66.1	−0.01 −0.06	85
GB	66.1	−0.01 −0.06	85
JD	73.7	−0.01 −0.06	85
JB	73.7	−0.01 −0.06	85
JF	75.95	−0.11 −0.16	85
JD 4 PS	75.95	−0.11 −0.16	85

G22 G22

Seite 7



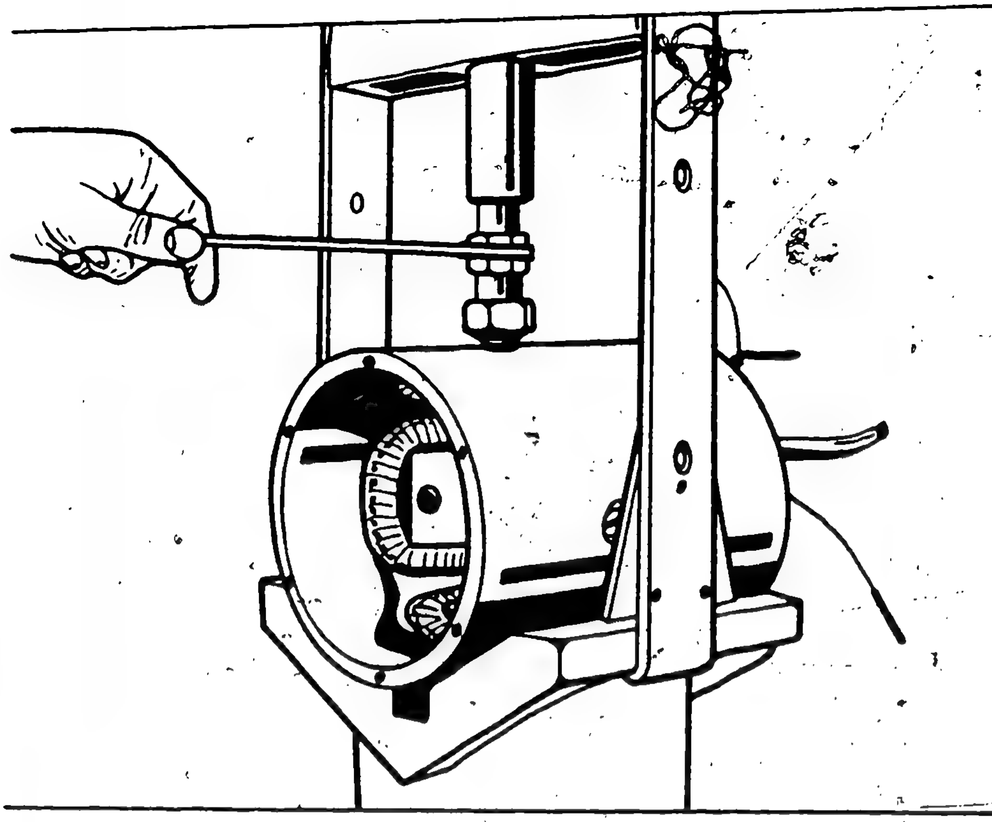


18

Driving-in mandrel

Material: St 34.11
If applicable with hole to save weight.
Wall thickness 12 ... 15 mm.
Mark with dia. on end face.

S 23



19

For installing the excitation windings so as to achieve the prescribed air gap between the pole shoes and armature. Tilting of the pole shoes is also thereby prevented.

9 24

3. Lubrication table

General:
The exploded views show the lubrication points with the prescribed lubricants. Apply a small quantity of oil to bright parts (screws, nuts, spigots etc.).

Greased parts (including roller and needle bearings) are to be degreased before relubrication.

Only fill roller and needle bearings with grease on one side.

Self-lubricating bearings should be placed in oil (Ol 1 v 13) for roughly 1 hour prior to installation.

When performing assembly work the joints are to be sealed with Kk 1 v 3.

The commutator and carbon brushes are to be kept grease and oil free.

Lubricants and sealers required

Greases			
Ft2 v 1	tin	250 g	5 700 080 135
Ft2 v 3	tube	50 g	5 700 082 005
	tube	250 g	5 700 082 025
Ft2 v 5	tin	500 g	5 700 084 150
Oils			
Ol 1 v 13	can	0.1 l	5 701 042 511
VS 12037	can	1.0 l	5 944 290 610
Sealing putty			
Kk 1 v 3	tin	0.5 kg	5 703 452 150
		1.0 kg	5 703 452 210
Kk 68 v 1		0.5 kg	5 703 210 150
		1.0 kg	5 703 210 210
VS 9844 Kk	tube	20 g	5 927 350 002

4. General starting motor repair

The work described below in this section applies to all starting motor types with top-mounted relay.

Other work is described in Section 5 as well as the mechanical test specifications and exploded views of passenger car starting motors.

4.1 Disassembly

As regards the starting motors 0 001 000 .. and 0 001 050 .. particular care should be taken when clamping housings since the built-in oxide magnets are sensitive to pressure and impact.

When removing the armature take care that the shim does not get stuck at the oxide magnet.

Permanent magnets and spherical bearings cannot be replaced. In the event of damage replace entire housing.

Loosen brush plate fastening screws on commutator end. Unscrew and carefully remove commutator end shield since helical compression springs may jump out of brush holders.

General:
Unscrew **cap.** Remove shims and positioning disc. In doing so pay attention to rubber ring.

Loosen **excitation winding connection.**

Loosen relay fastening screws. Remove relay from drive-end-bearing housing, in doing so detach relay armature at control lever.

Loosen through bolts.

Remove **commutator end shield.**

Remove carbon brushes from brush plate.

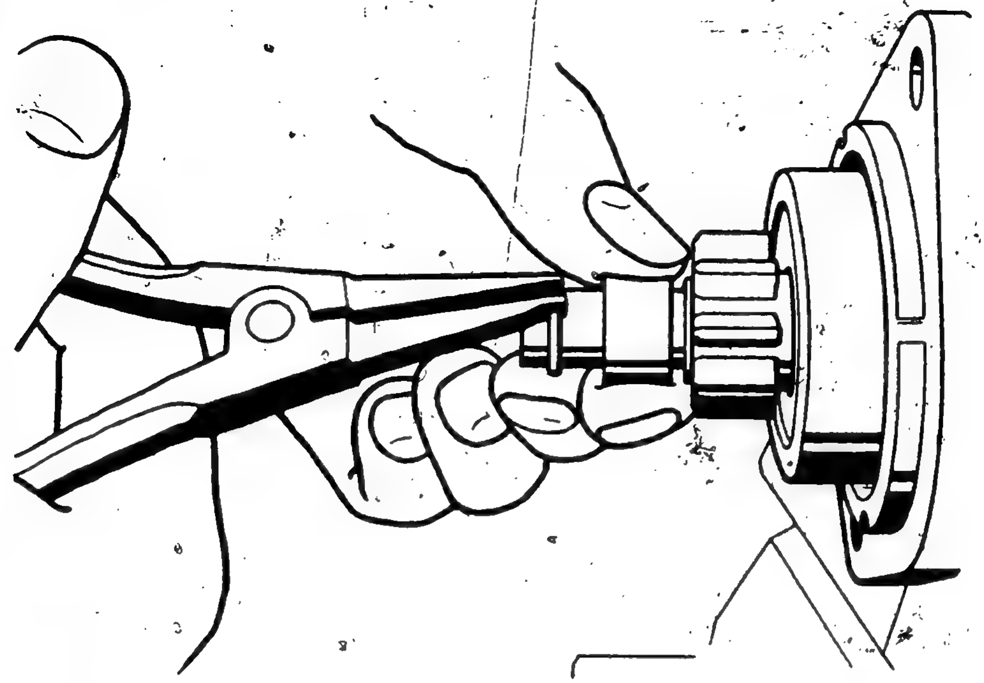
Remove **brush plate** from armature shaft.

Detach **stator frame** from drive-end-bearing housing, in doing so pay attention to rubber profile strip and metal plate.

Unscrew through bolts from drive-end-bearing housing.

Remove **control lever** with armature from drive-end-bearing housing.

Clamp **armature** in clamping support. Force back stop ring with suitable tool, sleeve KDAL 5027 or 5028 or 5029 and hammer.



20

Using suitable pliers (commercially-available) bend both ends of retainer wide apart so as to prevent damage to armature shaft when removing retainer (Fig. 20).

Carefully remove any burrs at slot using a bastard file to prevent damage to the mechanism bushing.
Remove mechanism.

In the case of all starting motors

0 001 212 ..	}	EB
.. 213 ..	}	EB
.. 215 ..	}	EB
.. 312 ..		GB
.. 356 ..	}	JB
.. 357 ..	}	JB

clamp armature.

Press locking device with brake disc onto mechanism and remove from armature shaft. Pay attention to balls in locking ring.

4.2 Cleaning of parts

Wash parts in a non-flammable commercially-available cleaning agent **taking care to observe the safety regulations!**
After washing, blow out parts with compressed air (max. 4 bar).
Do not place armature, windings, bearings and relays in washing agent.
Important:
Thoroughly dry cleaned parts as gases could subsequently form in a sealed starting motor and an explosion could result.

4.3 Inspection and repair of individual parts

All parts are to be investigated for wear and mechanical damage.

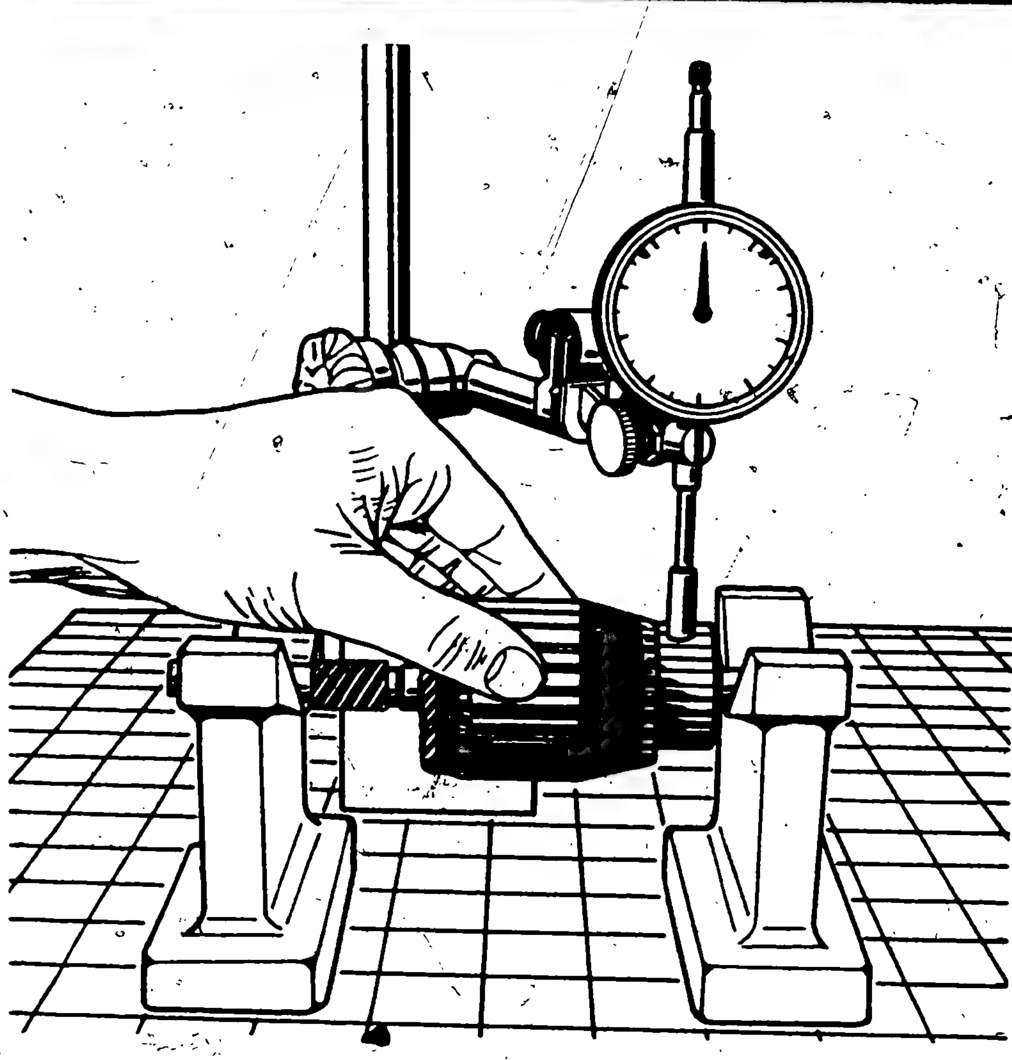
A small quantity of oil is to be applied to bright parts.

4.3.1 Check armature for short circuit to chassis using EFAW 81 and EFAW 82.

Test voltage: 40 V for 12 V starting motors
80 V for 24 V starting motors

Check interturn short circuit using EFAW 90 or EFAW 95.

Turning down of commutator (for this purpose use tailstock chuck to support armature shaft).



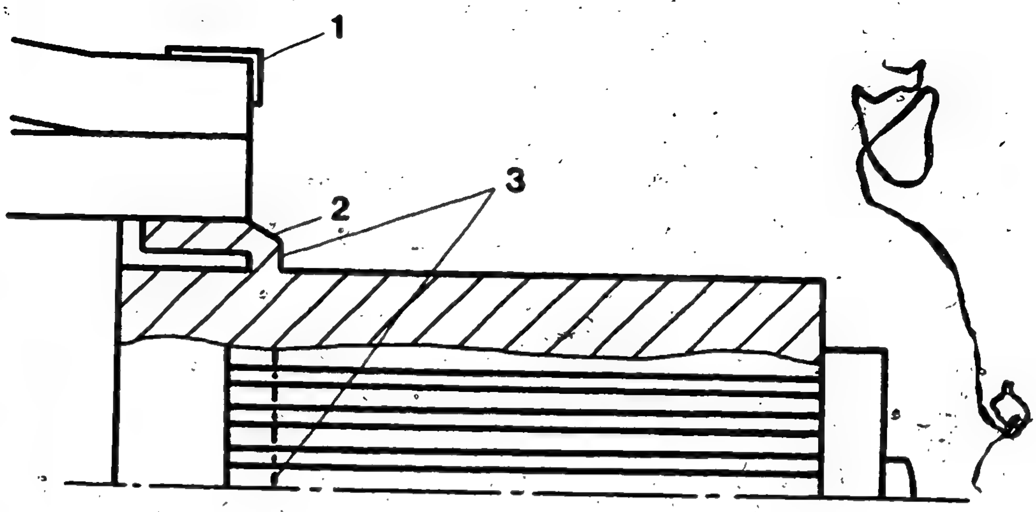
21

Permissible eccentricity:

at collector: max. 0.03 mm
at laminated core: max. 0.05 mm
(observe when turning down).

H 2

Seite 9



22

With newer armatures observe the following:

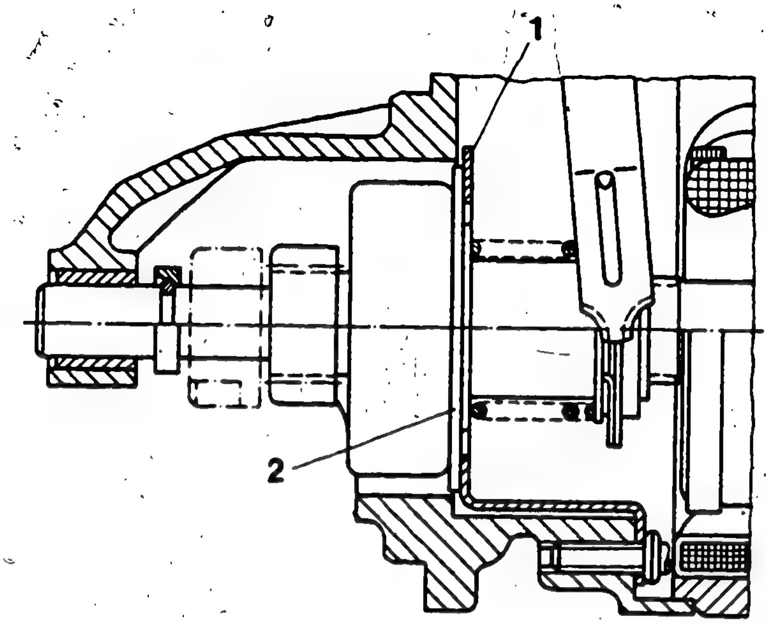
1 = soldering lug
2 = claw

3 = only turn as far as here

After turndown, saw out segment insulation (approx. 0.5 mm deep) using undercutting saw and then finish-turn commutator.

Do not turn down armature laminations.

Ensure good joints between commutator segments and soldering lugs. Check armature again for short circuit to chassis and interturn short circuit.



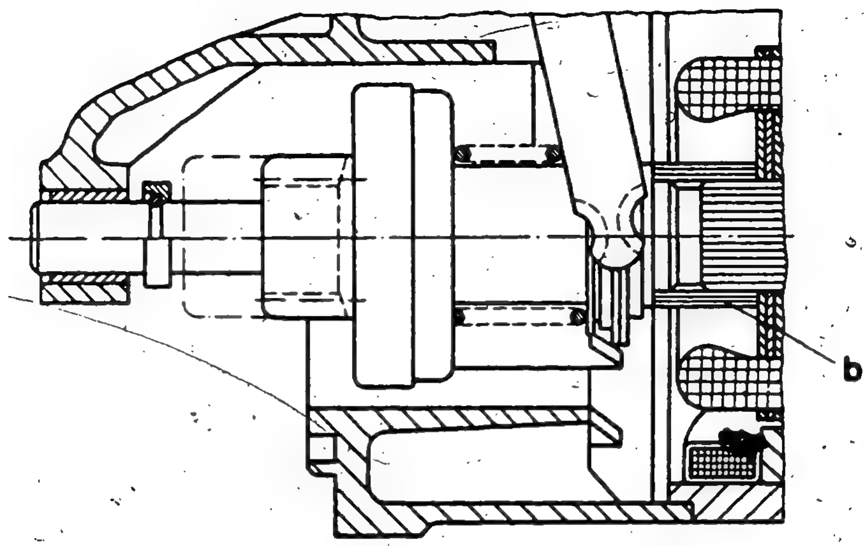
23

1 = Before performing conversion work remove gear stop on stop bushing.

2 = Before performing conversion work remove TX washer on stop bushing.

Armature brake in the case of EF starting motors
0 001 208 . .
. . 211 . .

Version
a) with gear stop and TX washer (Fig. 23)



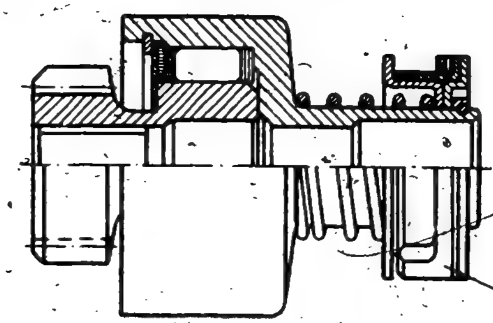
24

b) with stop bushing on armature shaft (Fig. 24)

0 001 359 . . JD 12 V 4 PS
. . 360 . . JD 24 V 4 PS
. . 364 . . JD 12 V 5 PS
. . 365 . . JD 24 V 5 PS

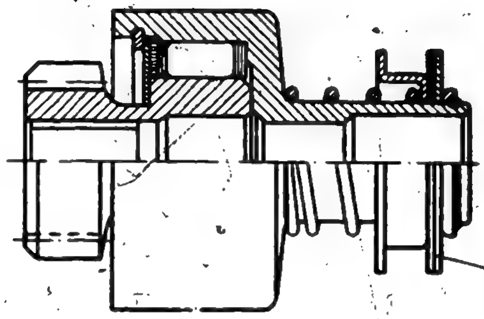
as of date of manufacture 428 (8.74) the armature brake with helical spring no longer applies.

H 5



1

25



2

26

1 = plastic washer

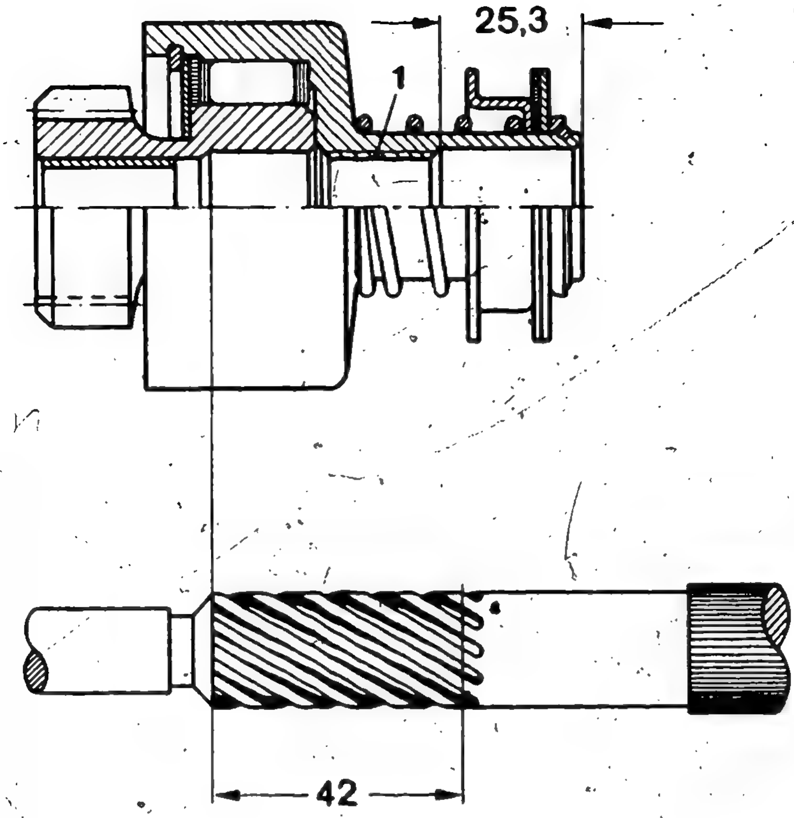
2 = TX washer

Starting motors 0 001 359 . . JD 12 V 4 PS
. . 360 . . JD 24 V 4 PS
. . 364 . . JD 12 V 5 PS
. . 365 . . JD 24 V 5 PS

At the same time a changeover was made in the case of 6-roller mechanisms from a plastic washer to a TX washer (Figs. 25 and 26) and brush compression springs were fitted with a pressure of 36–38 N (3600–3800 p), previously 26–28 N (2600–2800 p).
As of date of manufacture 521 (1.75) the starting motors 0 001 359 .. and 0 001 300 .. no longer have a shunt field. When replacing the windings by windings without a shunt field the stronger brush springs must also be fitted at the same time.

H6

Seite 10



27

1 = position of spiral spline

Roller mechanisms for JD starting motors

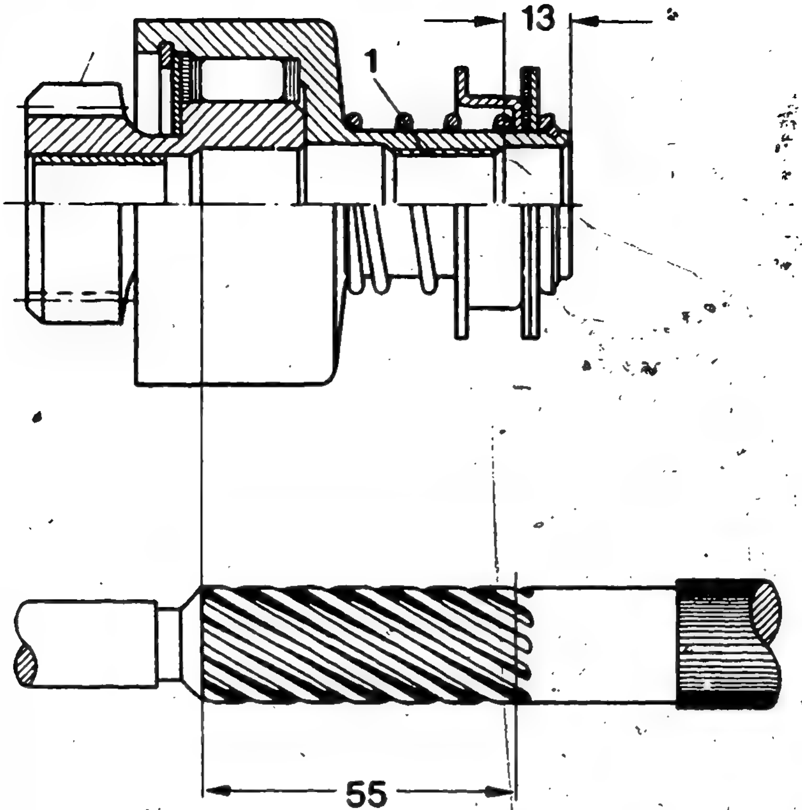
As of date of manufacture 431 (11.74) the 5-roller mechanisms are no longer always interchangeable with the 6-roller mechanisms in view of the fact that the position of the spiral spline in the driver was changed (Figs. 27 and 28). In the case of starting motors with shunt field the spiral spline was modified from a length of 42 mm to a length of 55 mm:

in the case of	0 001 359 . .	JD 12 V 4 PS	as of 12.72
in the case of	. . 360 . .	JD 24 V 4 PS	
in the case of	. . 364 . .	JD 24 V 5 PS	as of 12.73
in the case of	. . 365 . .	JD 12 V 5 PS	

Starting motors without a shunt field always had a 55 mm long spiral spline:

. . 359 . . JD 12 V 4 PS
. . 360 . . JD 24 V 4 PS

H7

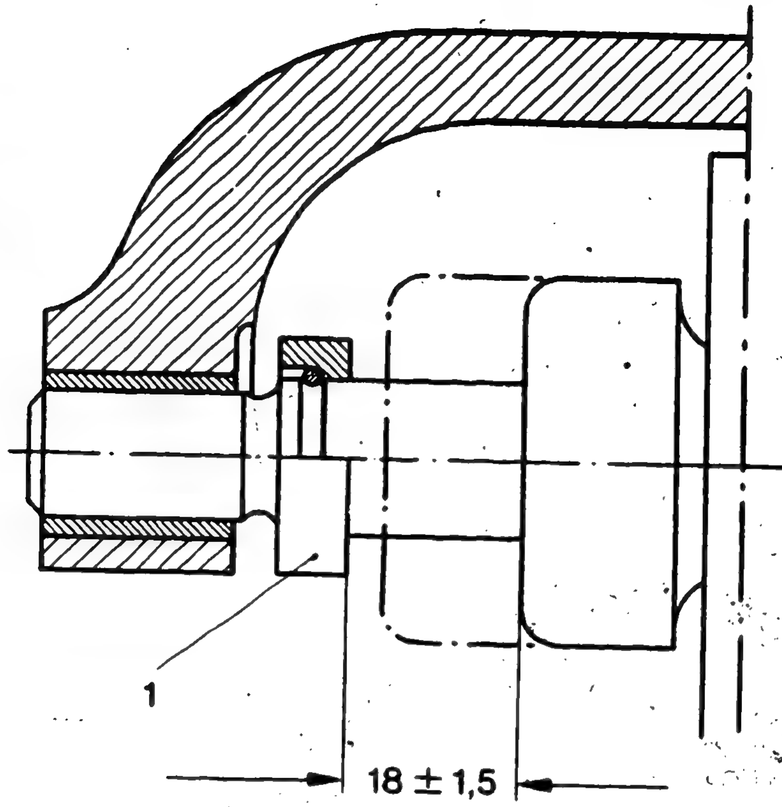


28

1 = spiral spline

As regards the last-mentioned starting motors use can either be made of the 5-roller mechanism, the modified 6-roller mechanism or the old 6-roller mechanism (if still available). Armatures with a short spiral spline (42 mm) can only be mounted together with the 5-roller mechanism.

H 8



29

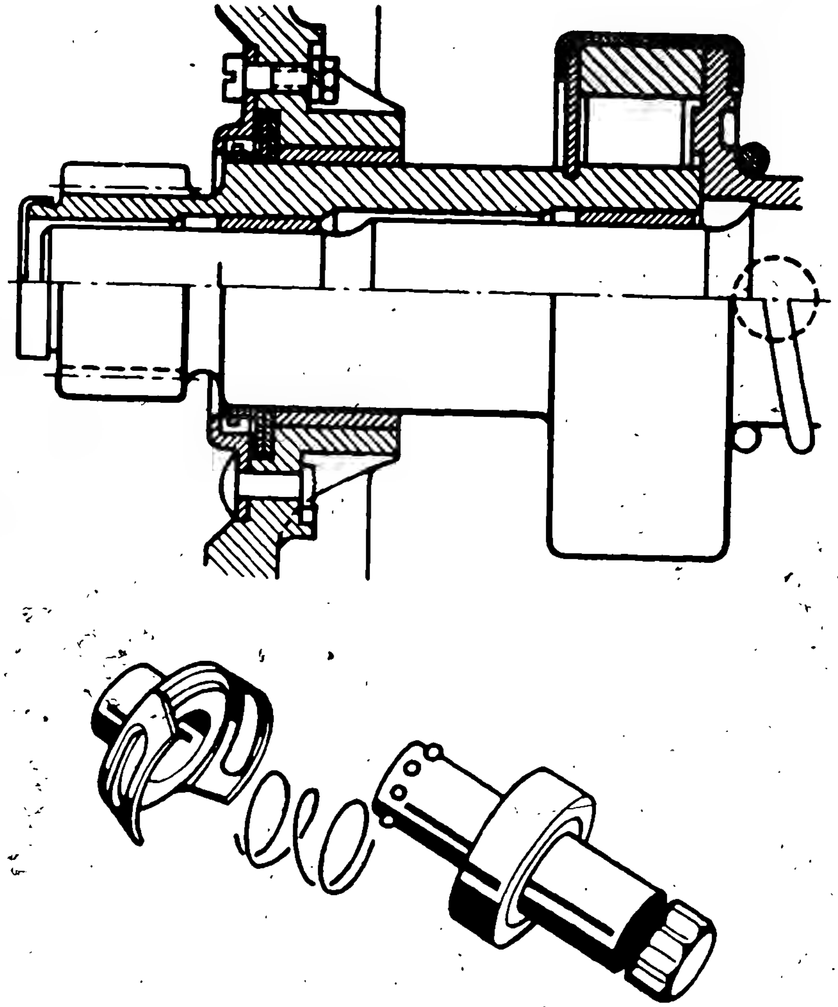
1 = Stop ring
As a check the spacing between the pinion (in the rest position) and stop ring is to be measured whenever repair work has been performed. The spacing should be 18 ± 1.5 mm (Fig. 29).

As regards the starting motors

0 001 362 . . . . 363 . . . . 366 . .	JF

the mechanical armature brake no longer applies as of date of manufacture 621. Instead the brush pressure was increased in the case of the tubular brush holder to 24 N (2400 p).

At the same time the starting motors were provided with a 6-roller-type overrunning clutch (previously 5 rollers). The armature shaft has a shorter spiral spline and a stop for the overrunning-clutch drive. The 6-roller-type overrunning clutch can also be fitted into older JF starting motors. The previous armature is still available.

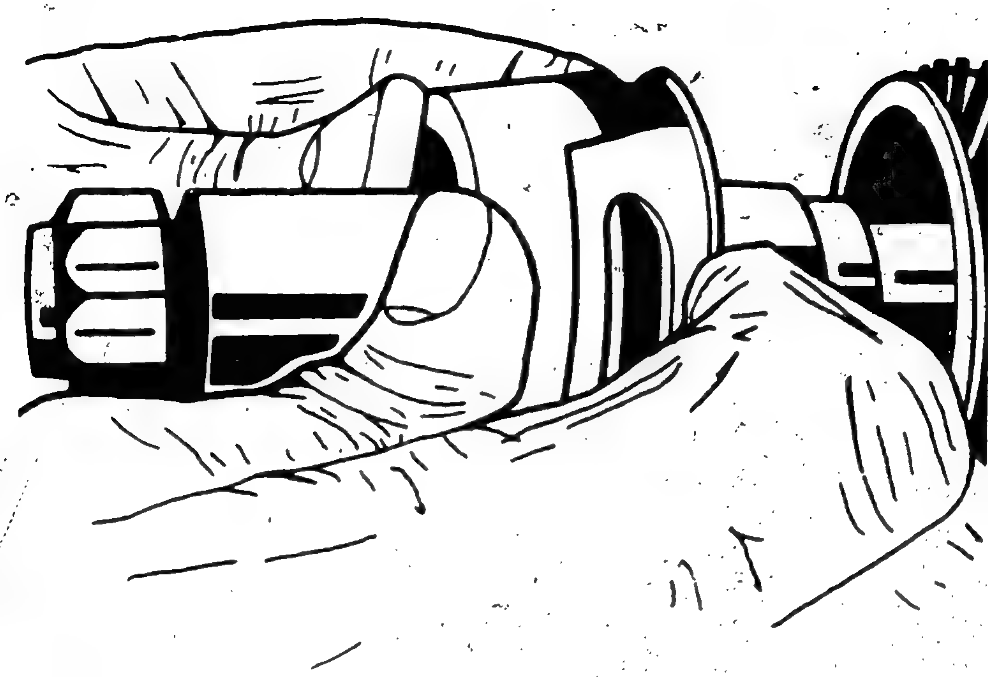


30

Roller mechanism for the EB, GB, JB starting motors
0 001 212 . .
. . 213 . .
. . 215 . .
. . 3121 . .
. . 356 . .
. . 357 . .

When **mounting the mechanism** the balls are to be inserted into the locking ring with FT 2v3 grease (Fig. 30).
Clamp armature in clamping support.

LL 10



31

Push mechanism with locking ring and brake disc on to armature shaft until balls engage in armature shaft recess (Fig. 31).

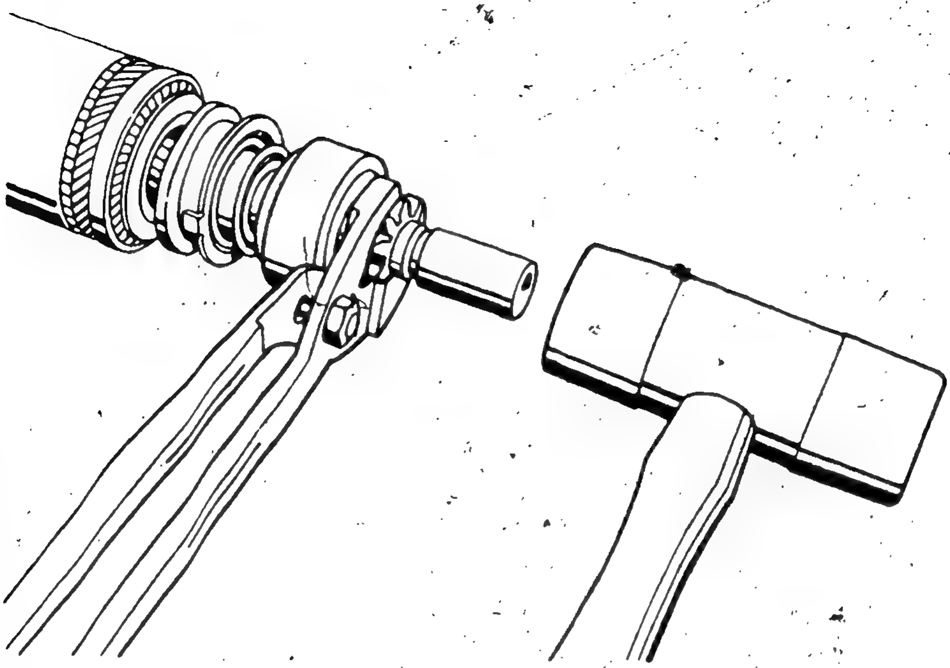
Check whether locking ring is properly seated on armature shaft.

After unlocking, the mechanism must move freely on the armature shaft (Fig. 31).

Test specifications: cf. technical data and mechanical test specifications.

Lubrication during assembly work is to be performed in accordance with the exploded views showing the lubrication points.

Armature installation
Clamp armature in clamping support. Push mechanism and stop ring on to armature shaft.
In the case of starting motors with an intermediate bearing the mechanism must be attached to the armature shaft with the intermediate bearing.



32

Mounting retainer on armature shaft
(do not clamp armature).

KDAL 5027 for 11 mm armature shaft dia.
KDAL 5028 for 12 mm armature shaft dia.
KDAL 5029 for 14.3 mm armature shaft dia.

Using special pliers slightly open new retainer and insert into armature ring slot. Take care not to scratch armature shaft! Using pipe wrench or water-pump nut pliers press retainer together in ring slot. Push suitable mounting sleeve on to armature shaft (turned side of sleeve faces retainer). Using pipe wrench pre-turn pinion and in doing so press against stop ring. Secure in this position. The retainer is engaged in position under the stop ring by hammering (plastic hammer) on the sleeve (Fig. 32).

As regards the old **EED starting motors** (with inward clamping retainer) the following tools should continue to be used:

KDAL 5484 mounting device for pushing on retainer.
KDAL 5487 caulking tool for caulking stop ring.

In the case of armatures with castle nuts always push new retainer on to armature shaft using special pliers until retainer engages in the slot. Screw on castle nut and fix with a split pin.

H 13

4.3.2 Drive-end-bearing housings, commutator end shields and intermediate bearings

Replace worn bushings. Before pressing in self-lubricating bushings place them for 30 minutes in oil (OL 1 v 13).

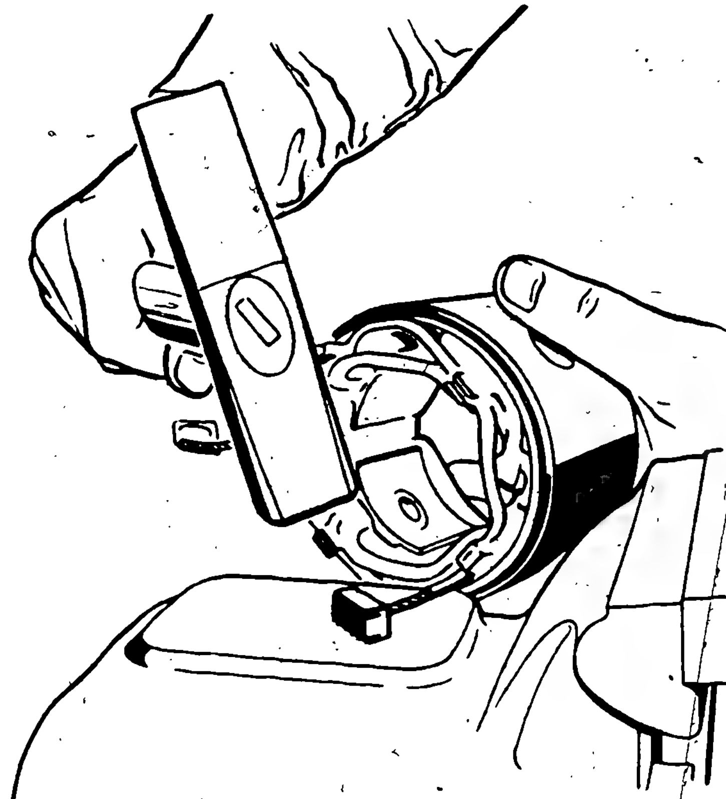
In the case of starting motors
0 001 212 . . (EB)
. . 213 . . (EB)
. . 215 . . (EB)
. . 312 . . (GB)

press in bushings with or without collar from inside of drive-end-bearing housing using appropriate press-in tool. Bushings with collars are only caulked on the collar end, whereas bushings without collars are caulked on both ends.

Sealed drive-end-bearing housings for the starting motor 0 001 356 .. (JB) are provided ex-works with a riveted-on closing cover. To replace the seal the rivets must be drilled out and replaced by screws and nuts (exploded view 74).

In the case of the starting motors
0 001 362 . . (JF)
. . 363 . . (JF)
. . 366 . . (JF)

there are drive-end-bearing housings made of aluminum pressure die castings (open design) and grey cast-iron versions (closed design). If a new housing is fitted as replacement for a previous version, then it must be centred with respect to the stator frame using the stay bolts, since a suitable locating device is no longer available. The stay bolts may not contact the excitation winding.

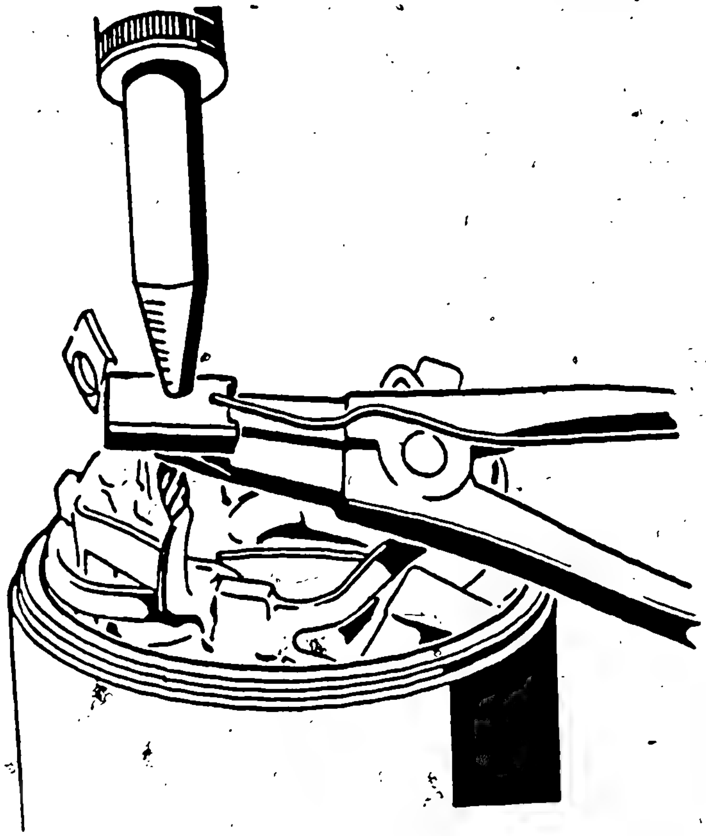


33

Carbon brushes must move freely in the guides in the brush plate. Damaged, rusty or burnt-out springs should be replaced;

a) with screw connection for JD starting motor
b) with soldered connection for D, E, G and JF starting motors

Shatter or crush old carbon brushes (Fig. 33).

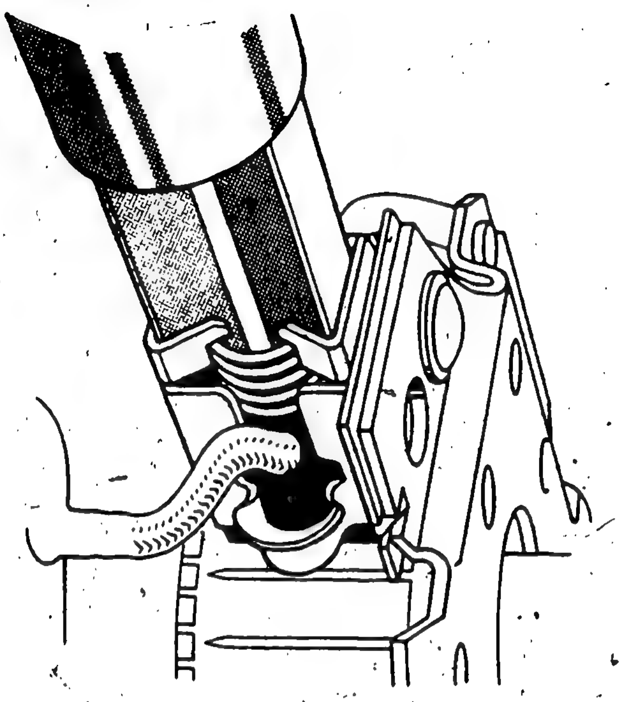


34

Scratch end of strand until bright. Place through hole in replacement carbon brush, force apart on other side of brush and solder (Fig. 34). In doing so hold strand with pliers directly behind carbon brush.

Use a 250–350 W soldering iron and soldering paste. After soldering the latter must be washed with ethanol or trichloroethylene.
Any protruding tin should be filed down.
Check freedom of movement of carbon brush in brush holder.

35



36

c) Tubular brush holders with helical compression springs.
To replace the carbon brushes the 4 retaining lugs should be bent up (Fig. 35). When fitting the new carbon brushes, the brushes and springs are to be pressed down using the assembly tool (Fig. 36). Using flat-nose pliers bend retaining lugs back in accordance with shape of assembly tool.

Measuring brush pressure
Depress carbon brush with spring scale until it is roughly 1 mm from edge of brush holder (corresponds to position when fitted)...

4 17

4.3.3 Stator frame inside diameter

J starting motors
0 001 354 . . JD 1.8 PS
. . 358 . . JD 3.0 PS
. . 359 . . JD 4.0 PS
. . 360 . . JD 4.0 PS
. . 362 . . JF 2.5 PS

When simultaneously disassembling several starting motors take care that the pole shoes of broached and drawn stator frames are not mixed up. Drawn stator frames have spigots on either side on the inside.

	broached up to 1972	drawn as of 1973
Stator frame inside diameter	97.55 + 0.1 mm	97.05 + 0.1 mm
Pole shoe height	11.8 −0.15 mm	11.55 −0.15 mm

In the case of all starting motors
Check **excitation winding** and insulated brush plate for short circuit to chassis.

Test voltage: 40 V for 12 V starting motors
80 V for 24 V starting motors

Windings should be neither scorched nor unsoldered.

Check windings for continuity.

Check with EFAW 81 and EFAW 82 as well as test prods EFAW 84.

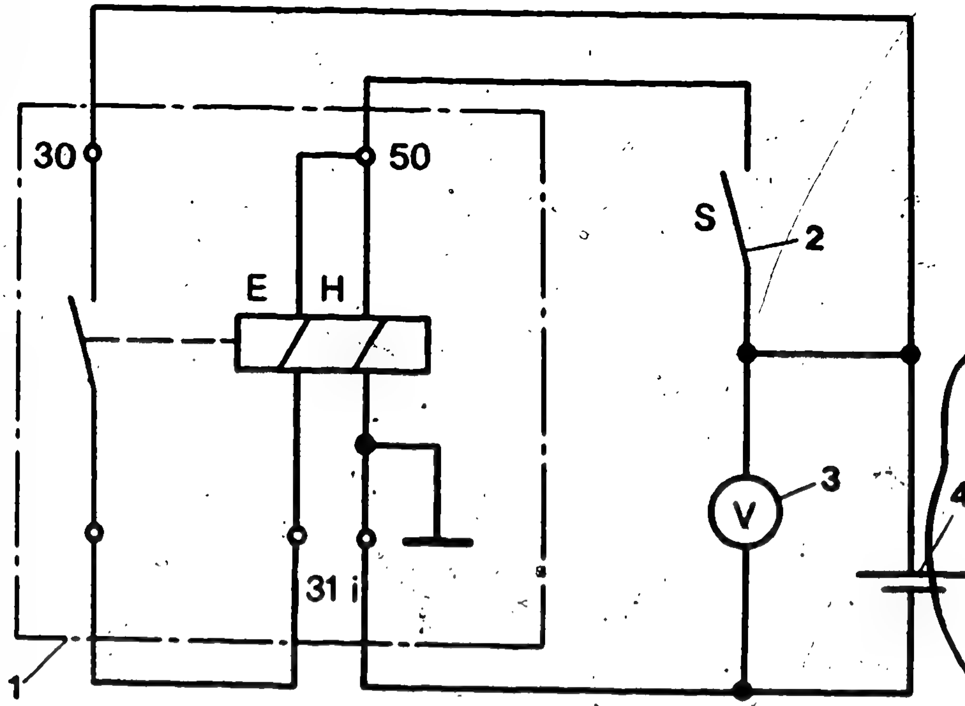
Replace damaged excitation windings.
Slightly heat new excitation winding prior to installation.

4.3.4 Relays
(Check when disassembled)

In the event of water damage replace complete relay.

Continuity and insulation test

Check windings with test and transformer panel for continuity using 6 V AC. Check windings insulated with respect to ground and contact studs for short circuit to chassis. Test voltage for 6 V and 12 V relays: 40 V AC, for 24 V relays: 80 V AC.



37

Test set-up comprising:

1 = test specimen (solenoid switch)
2 = ON/OFF switch
12 V 60 A or 24 V 30 A
e.g. ignition and starting switch

3 = voltmeter 15/30 V
4 = batteries 12 V 36 Ah
for 12 V relays (qty 2)
for 24 V relays (qty 4)

High-voltage test with twice the rated voltage
(interturn-short-circuit test)

This test is particularly important if the solenoid switch has stuck, since interturn short circuits of the coil can be recognized without any doubt.

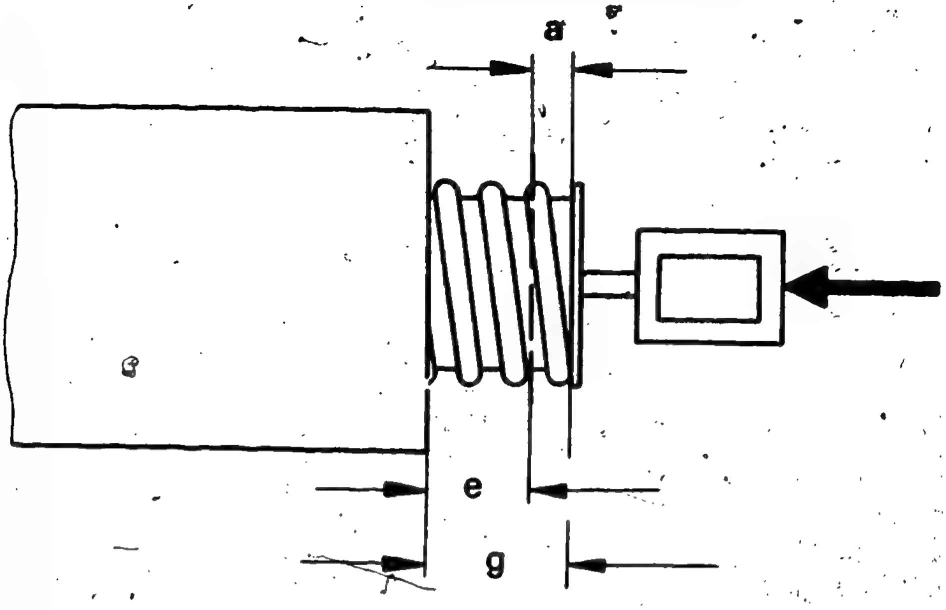
Connect relay in accordance with diagram 37.
Using switch "S" apply twice the rated voltage to the holding winding (do not step up voltage).

Important; relays with stronger return spring are to be additionally pressed in manually since the magnetic force alone is not sufficient.

Once the relay retracts open switch "S". Armature must deenergise immediately otherwise one of the two windings has an interturn short circuit.

Important: when the armature deenergises the armature travel must be limited by a stop so as to prevent damage to the insulating bushing and current bridge.

 ~~E28~~ LI 20 822

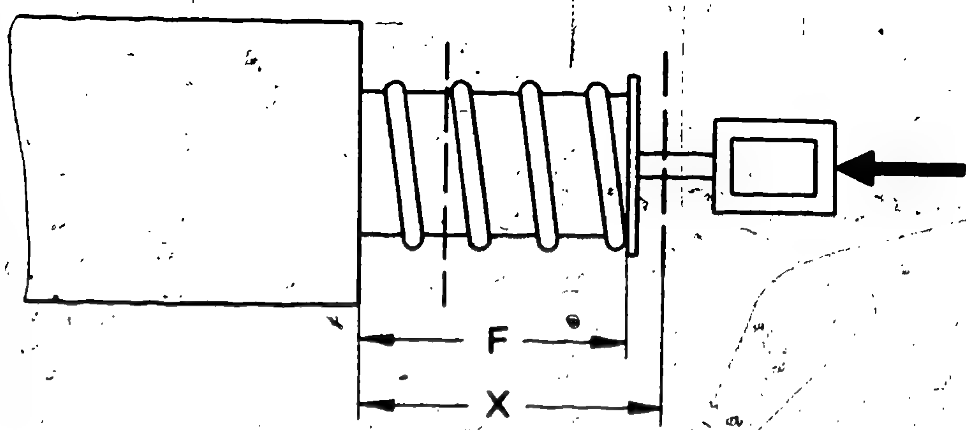


38

a = burn-off reserve
g = first contact via current bridge
e = end stop

Burn-off reserve (Fig. 38)
Press in armature by hand until current bridge contacts terminal studs. Dimension "g": first contact of current bridge. If the armature is pressed in further a noticeable increase in force is perceived.

The distance from this position to the mechanically-limited stop (dimension "e" reached) is the burn-off reserve. In the case of relays without a contact pressure spring, the burn-off reserve is the difference between the total armature travel and the armature travel as far as the contact support.



39

Total armature travel (Fig. 39)

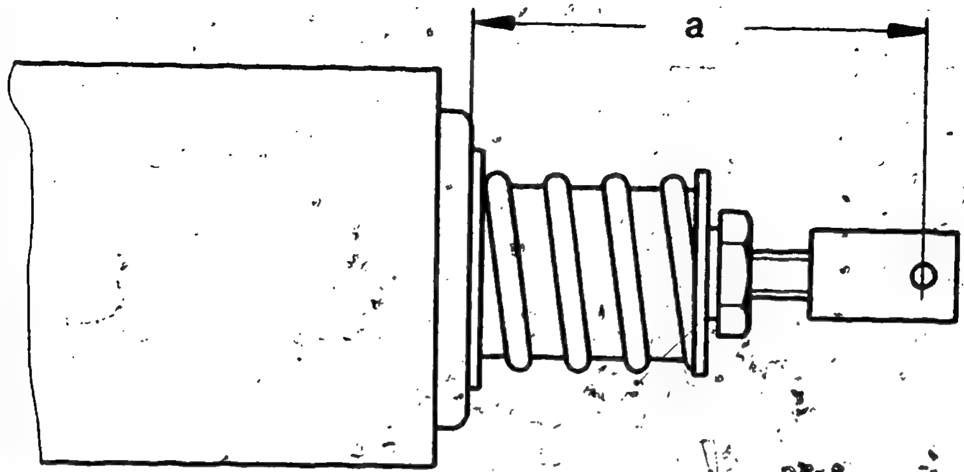
Measure cut-in position "F": in the case of a relay with contact pressure spring the dimension "F" differs from the dimension "X" (cut-out position). From cut-out position "X" press in relay roughly 1 mm until there is a noticeable increase in force. The distance which can still be covered as far as the mechanically-limited end stop is the total armature travel.

(In the case of relays without a contact pressure spring the total armature travel can only be measured if the relay cap is removed).

U 22

324

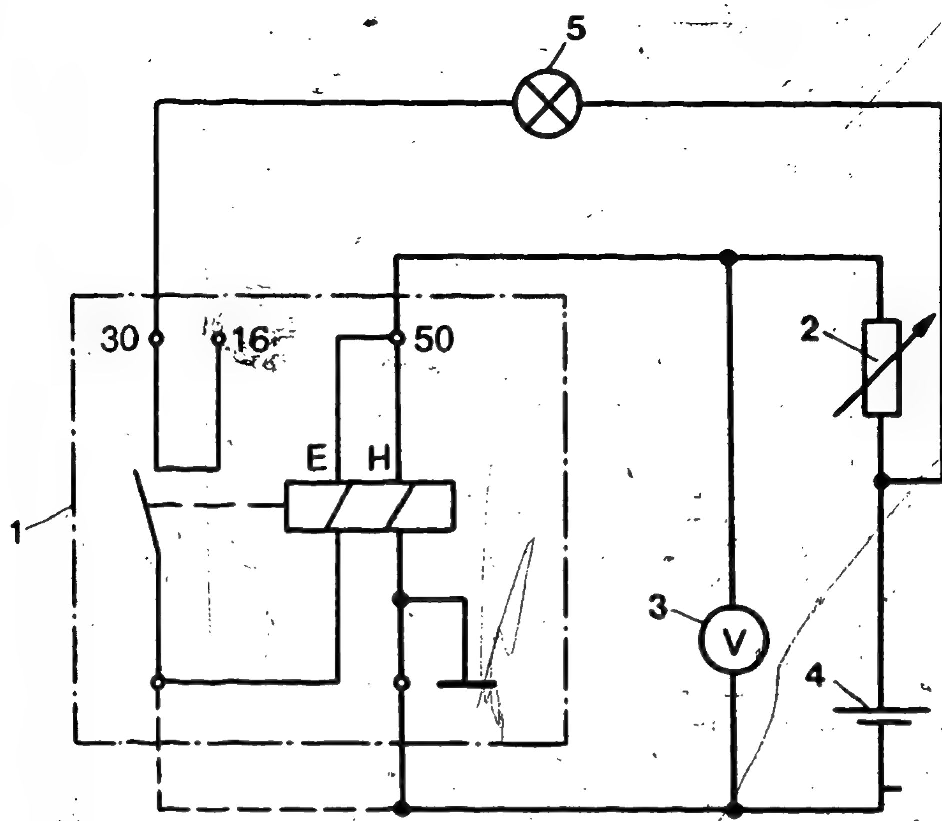
H22



40

Setting "a" (if adjustable) (Fig. 40)
Setting when disassembled.

Setting "a" is to be measured when the relay is retracted. Relay adjustment possibility as per Fig.: loosen nut and screw in or unscrew fork. Tighten nut. Other types of relay are adjusted using shims (cf. service-parts list).



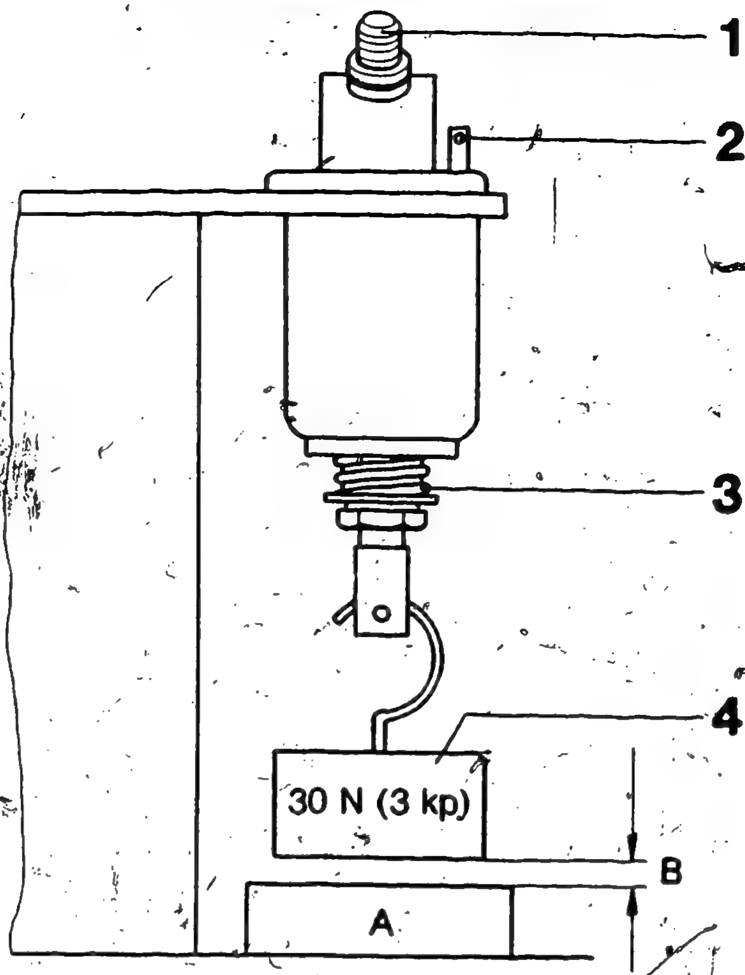
41

Test set-up comprising:

1 = Test specimen (solenoid switch)
2 = Regulating resistor
e.g. of tester
0 684 101 100 ETT 011.00,
0 681 100 101 EFAW 107
3 = Voltmeter
15/30 V
4 = Batteries 12 V 36 Ah
for 12 V relays (qty. 1)
for 24 V relays (qty. 2)
5 = Repeater lamp 24 V 18 W
6 = Suspension device

4.3.5 Voltage check with test set-up
(User manufacture)

If available, the previous solenoid-operated switch tester EFSH 2 can be used (this can no longer be supplied).



42

A = Base

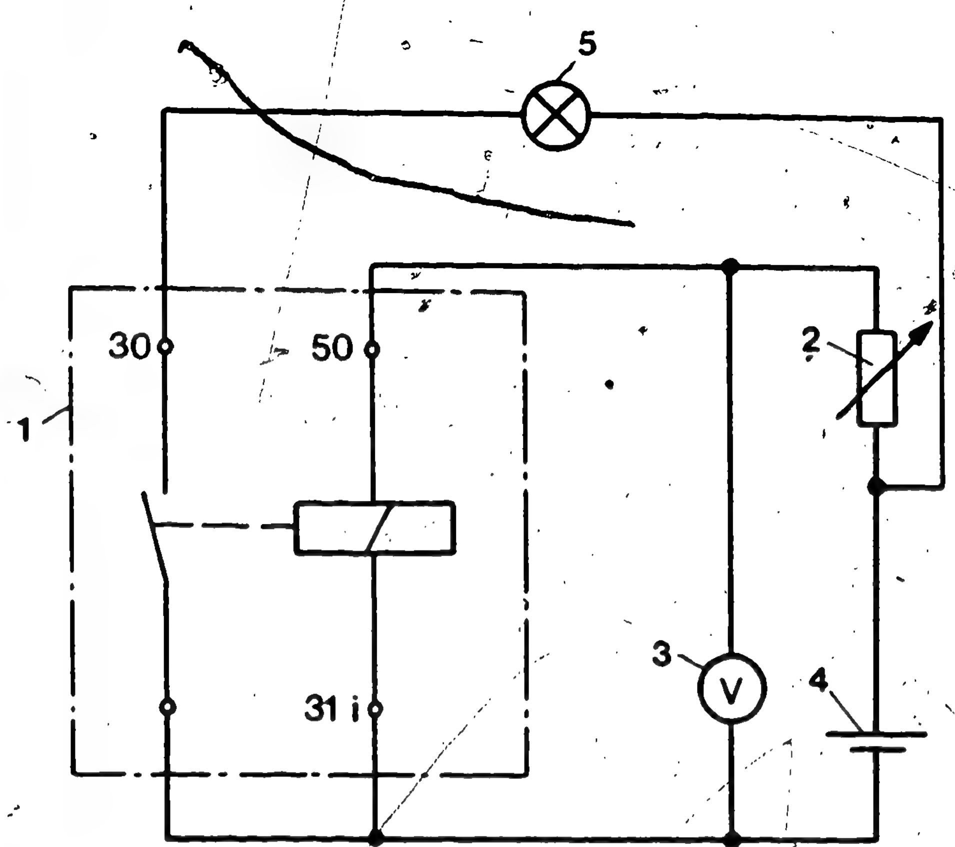
B = approx. 3 mm

1 = Terminal 30
2 = Terminal 50
3 = Retracted armature
4 = Weight

Important: ~~When the~~ armature de-energizes the armature travel must be limited by a stop to prevent damage to the current bridge and insulating bushing (Fig. 41).

ES II 25

G3



43

1 — Test specimen
2 — Regulating resistor
3 — Voltmeter
4 — Batteries 12 or 24 V, 36 Ah
5 — Repeater lamp 24 V 18 W

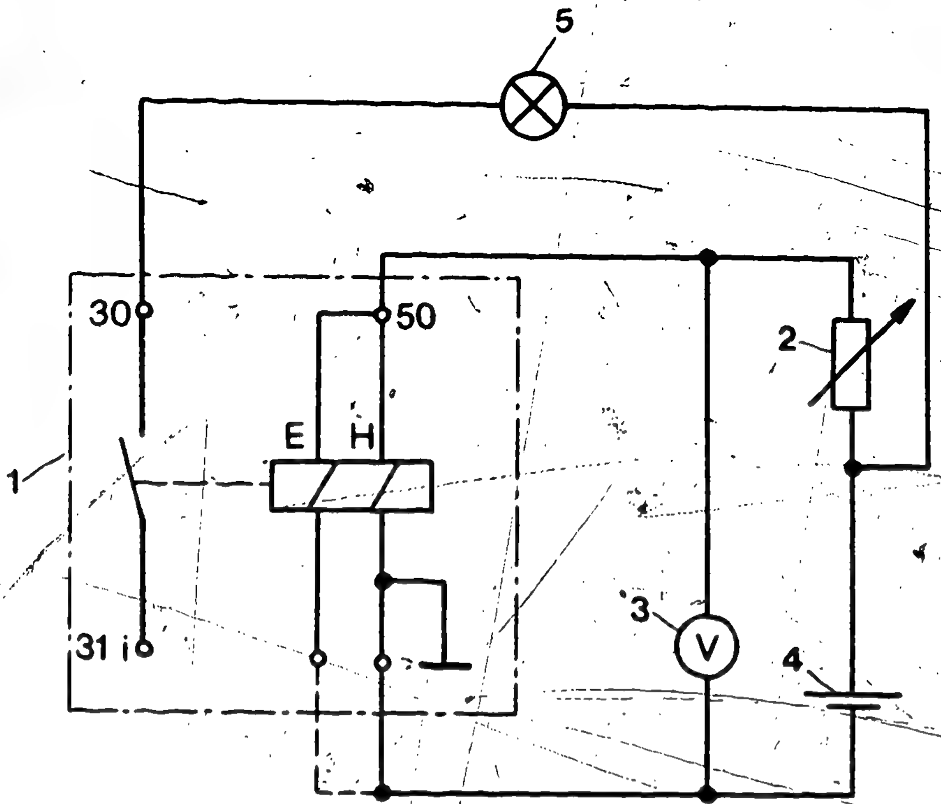
Pull-in voltage

Test position vertical, armature downwards.

Test with relay tester: place relay in tester suspension device. Attach weight if so required by test-specification sheet and use base

Apply rated voltage of relay to be tested. Turn or push resistor in direction of greater resistance as far as stop. Connect terminal „relay winding+" of tester to terminal 50 of relay and "relay winding−" to ground or terminal 31 i. In the case of relays with pull-in winding and holding winding both windings must be attached to negative terminal.

Connect "switching contact+" of tester to terminal 30 of relay and "switching contact−" to short screw terminal of relay.



44

1 = Test specimen
2 = Regulating resistor
3 = Voltmeter
4 = Batteries 12 or 24 V, 36 Ah
5 = Repeater lamp 24 V 18 W

Slowly increase voltage until repeater lamp lights or relay retracts. Measured pull-in voltage must be equal to or smaller than test value.

Release voltage

Circuit as in Section entitled "pull-in voltage". Allow relay to retract with rated voltage. If so required in test-specification table, disconnect pull-in winding i.e. disconnect negative lead from short screw terminal or terminal 31 i.

Slowly reduce voltage until armature de-energises or repeater lamp goes out. Displayed voltage must be equal to or less than test value.

4.3.6 Conversion notes for solenoid switches

In several starting motors the solenoid switches 0 331 401 ... were replaced by 0 331 402 ... In view of the fact that these relays are shorter than the previous design, parts sets are available comprising the following:

1 Solenoid switch
1 Intermediate disk
2 Longer screws.

When performing assembly work do not forget helical springs in electromagnet armature. As of date of manufacture 621 the solenoid switch no longer has a spigot.

4.4 Starting motor assembly

Mechanism must move freely on armature shaft.

Notes for starting motors 0 001 100 ...

To make for easier installation of the carbon brushes hold the brush plate with a threaded pin. Bend carbon brushes into the correct position, insert helical compression spring into brush holder and attach both parts together to the carbon brush.

Depress brush holder and allow to engage in T-shaped recess.

Mount housing cover, screw on brush plate.

Notes for starting motors
0 001 000 ..
.. 050 ..

When fitting the pre-mounted armature into the housing, take care that the shims are not pulled off the armature shaft by the oxide magnets. Furthermore the strands must move in the recesses without getting stuck at the brush holder.

Fix drive-end-bearing housing and stator frame in position with slot and lug (if provided). Insert square nut into slot and tighten screw.

Seal opening with insulating tape.

4.4.1 Starting motor assembly (general)

Insert armature together with engaging lever into drive-end-bearing housing.

Insert rubber seal between drive-end-bearing housing and stator frame. Tighten control lever bearing pin in drive-end-bearing housing. Push stator frame over armature.

In the case of starting motors with a detachable brush plate: attach brush holder plate to armature shaft. Insert carbon brushes.

Check brush pressure using spring scale (for values cf. Section 5 – mechanical test specifications). The anti-rotation safeguard of the brush plate must be observed.

Mount commutator end shield.
Observe armature longitudinal clearance.
Insert steel washers and insulating washers on commutator end in accordance with exploded views.

Tighten cap at commutator end shield.

Observe laying of leads and position of helical compression spring.

Rubber grommet of connecting lead must sit tightly (insulation).

Ground connections between brush plate and commutator end shield as well as between commutator end shield and housing must be bright.

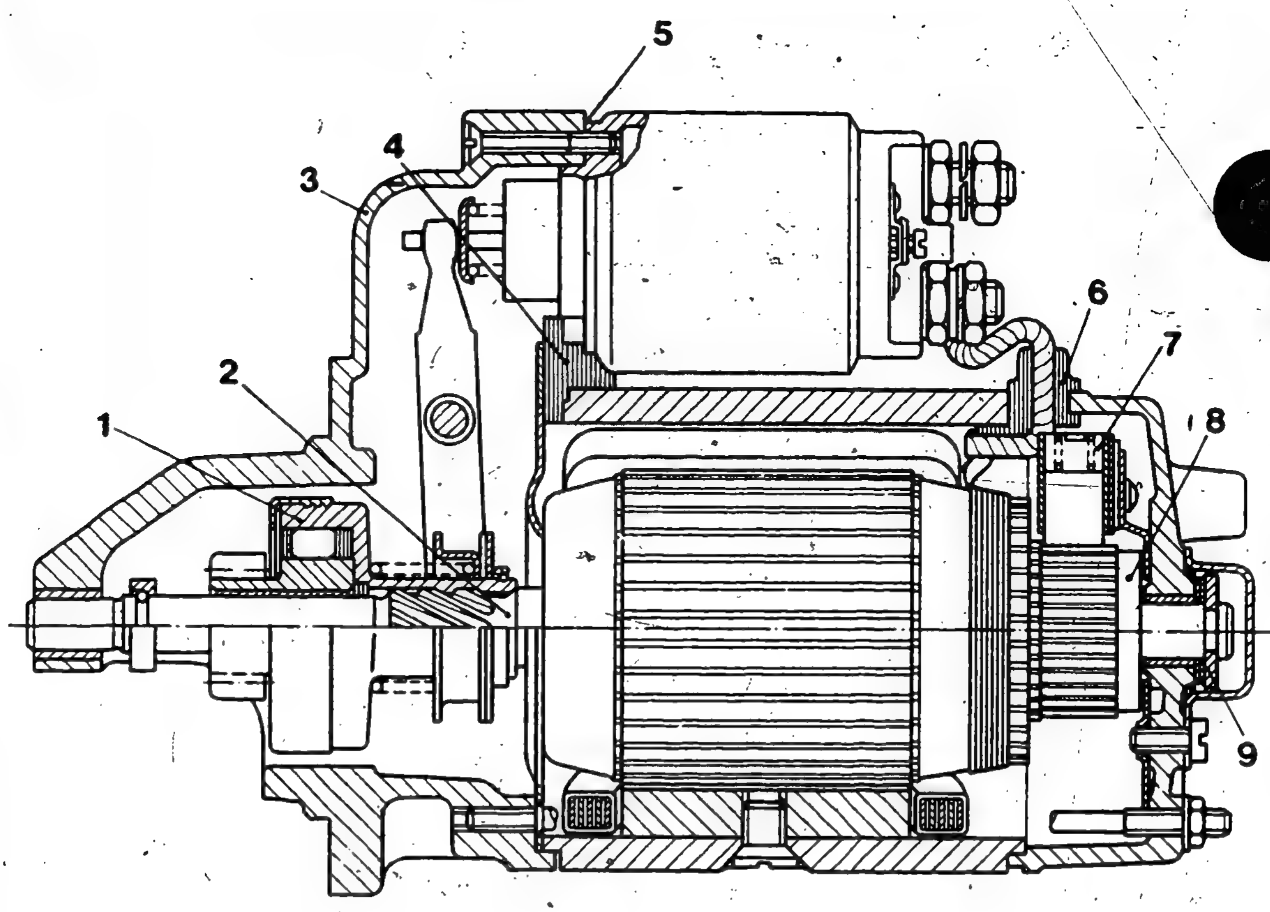
Place relay in position and secure at drive-end-bearing housing.
Attach winding connection at relay.

Check armature braking torque and overrunning torque.
(for values see Section 5 – mechanical test specifications).

For starting motors 0 001 362 .. and 0 001 363 .. (JF).

One shoulder of **commutator** contacts brush plate. Shims for the armature longitudinal clearance are only used externally on the commutator end shield.

Seite 16

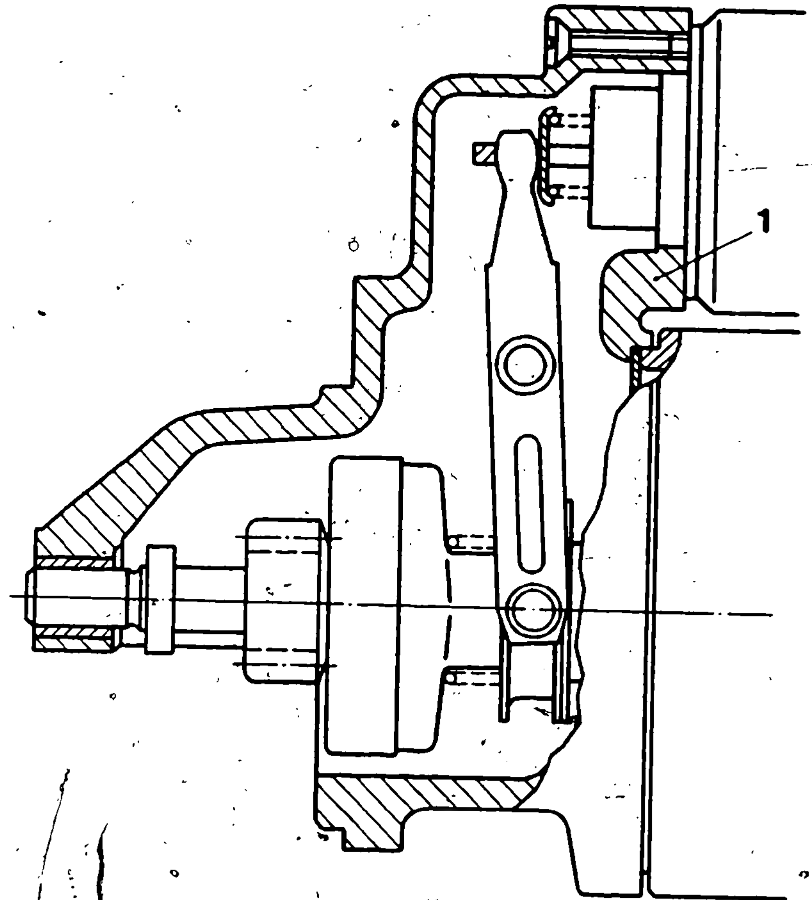


45

JF starting motor version with open drive-end-bearing housing (aluminum pressure die casting)

1 = 6-roller-type overrunning-clutch drive
2 = mechanism stop at armature shaft
3 = drive-end-bearing housing
4 = rubber seal
5 = no spigot for solenoid switch
6 = rubber seal
7 = tubular brush holder
8 = commutator contacts brush plate with protruding shoulder
9 = external armature longitudinal clearance adjustment

FM · M3



46

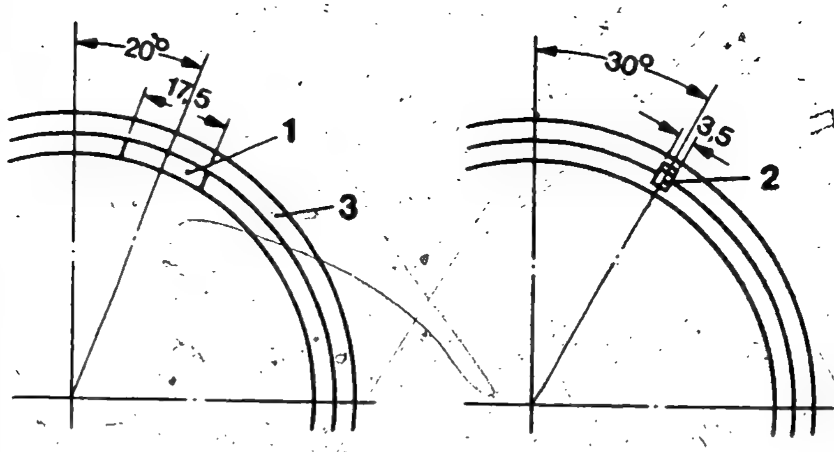
1 = seal slot with sealing putty

Closed drive-end-bearing housing (grey cast-iron) in the case of JF starting motors.

In the case of starting motors 0 001 362 .. and 0 001 36 .. stay bolts may not contact excitation windings. The open positioning slot should be sealed with sealing putty (Fig. 46).

The location of the positioning slots in the drive-end-bearing housing and intermediate bearing must tally.

Push insulating tubes over threaded pins.



47

1 = slot
2 = positioning lug
3 = stator frame

a) 17.5 mm slot (old version)
b) 3.5 mm positioning lug (new version)

In the case of JF starting motors:
positioning of stator frame with respect to drive-end-bearing housing up to date of manufacture 621 (1.76) by means of rubber seal and positioning slot in stator frame (Fig. 47 a and b). As of date of manufacture 621 positioning lug at stator frame and corresponding positioning holes in drive-end-bearing housing. In the case of older stator frames the missing positioning device must be replaced by means of centring with the stay bolts.

55

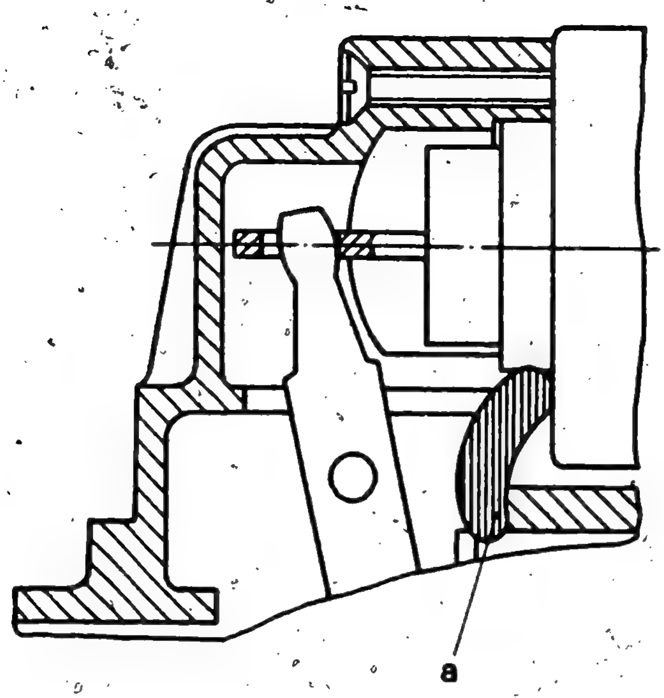
4.4.2 Sealing

To ensure that the starting motor does not leak all rubber gaskets are to be replaced and the sealing surfaces additionally coated with an even, thin coat of sealing putty.

Place rubber gasket correctly under intermediate bearing.

In the case of starting motors
0 001 362 016
and 0 001 362 024

particular care is to be taken. The joint between the commutator end shield and stator frame as well as the cable lead-through are to be coated with sealing compound Fl 58 v 3 or Fl 87 v 1. (Allow to thicken slightly).

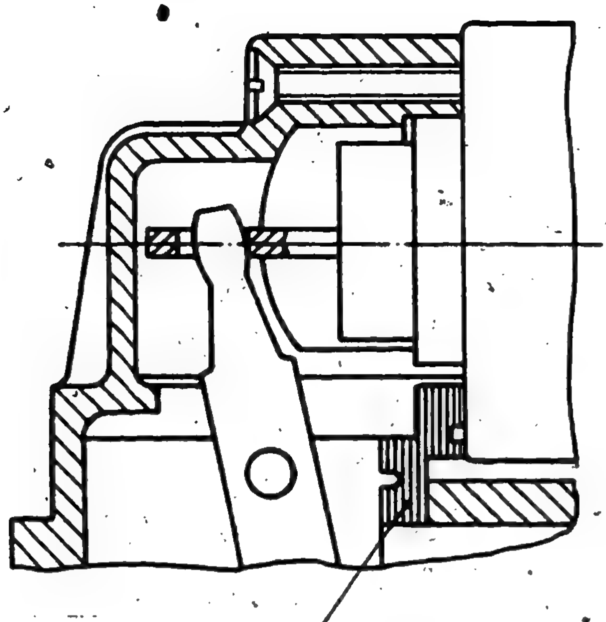


48

a) banana-shaped seal (Fig. 48).

4.4.3 Seals
(for EF starting motors 0 001 208 .. and 0 001 211 ..)

There are 2 types of seal between the drive-end-bearing housing and stator frame:



49

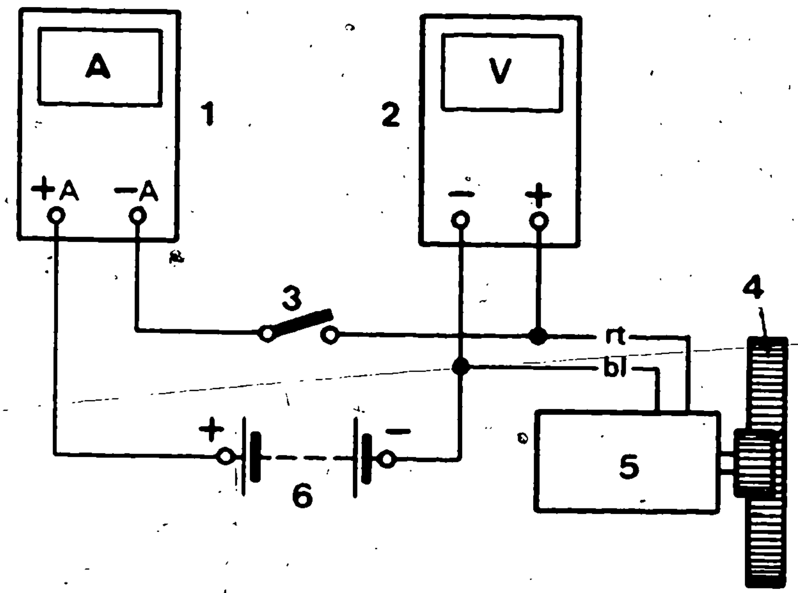
b) Z-shaped seal (Fig. 49).

(Seal a) is replaced by b)).

J8

5. Special features of individual types of starting motor

5.1 0 001 000 .. (CB 12 V 0.15 PS)
.. 050 .. (CB 12 V 0.15 PS)



1 = EFAW 120
2 = Voltmeter
3 = Switch

4 = Ring gear
5 = Starting motor
6 = Battery (3.5 Ah)

5.1.1 Check on starting-motor test bench. Ensure correct module of ring gear.

Do not clamp starting motor too tightly (to prevent housing deformation and fracture of oxide magnets). When adjusting backlash ensure that ring gear does not contact stop ring.

As regards small currents use is made of the volt-ammeter as opposed to the test bench instrument.

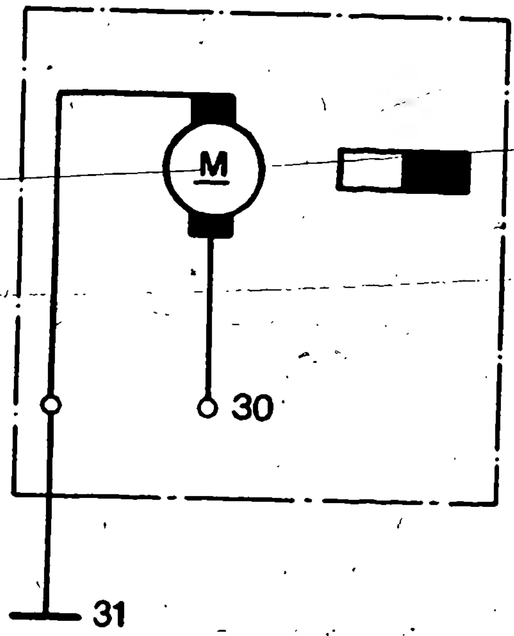
For idle test do not allow pinion to engage ring gear.

Only use prescribed batteries:
12 V 3.5 Ah, charged
(e.g. 0 181 081 500)

5.1.2 Mechanical test specifications

	(without relay)	
Brush pressure	N	1.8–2.2
Min. carbon brush length	mm	7.5
Setting "a" relay	mm	–
Burn-off reserve	mm	–
Armature longitudinal clearance	mm	0.1 ... 0.3
Armature braking torque	Ncm	2 ... 3
Overrunning torque overrunning clutch	Ncm	–
Commutator dimension (new)	mm dia.	23
Minimum dimension	mm dia.	22.5

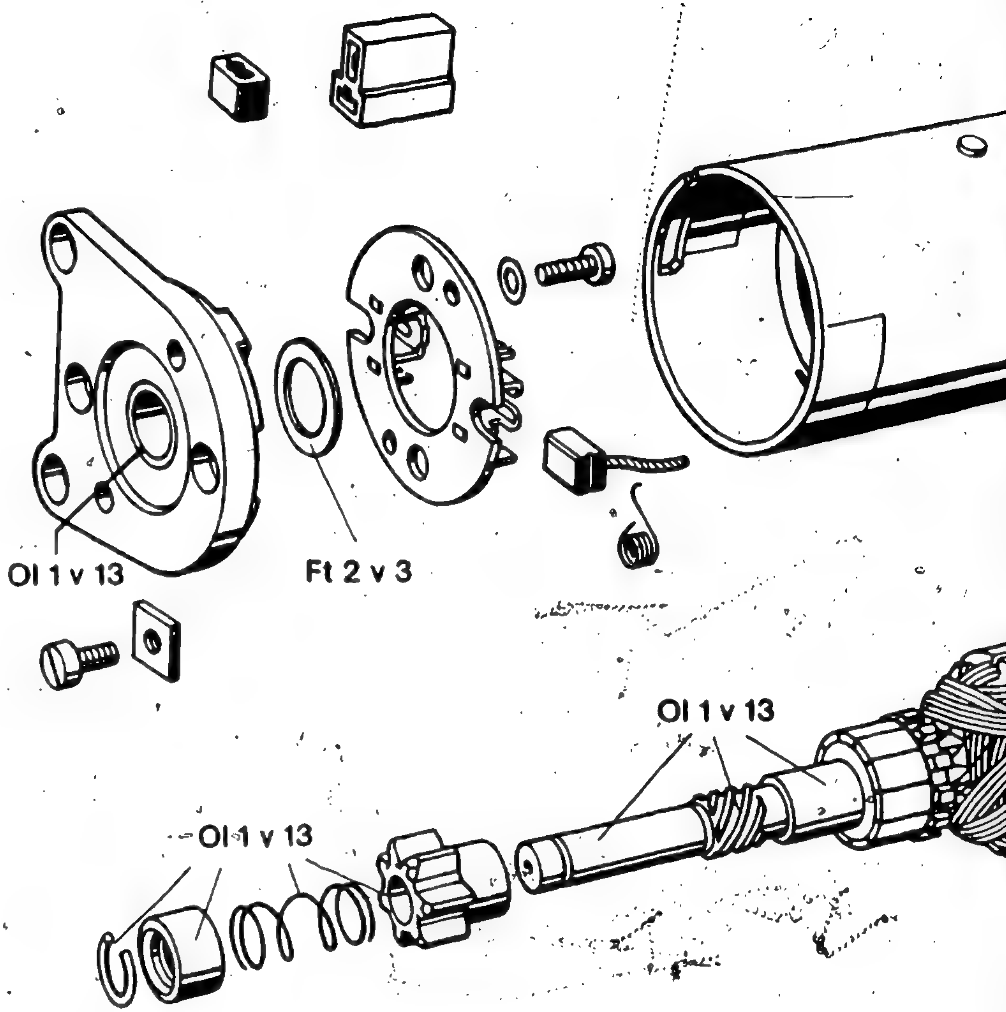
5.1.3 Diagram



51

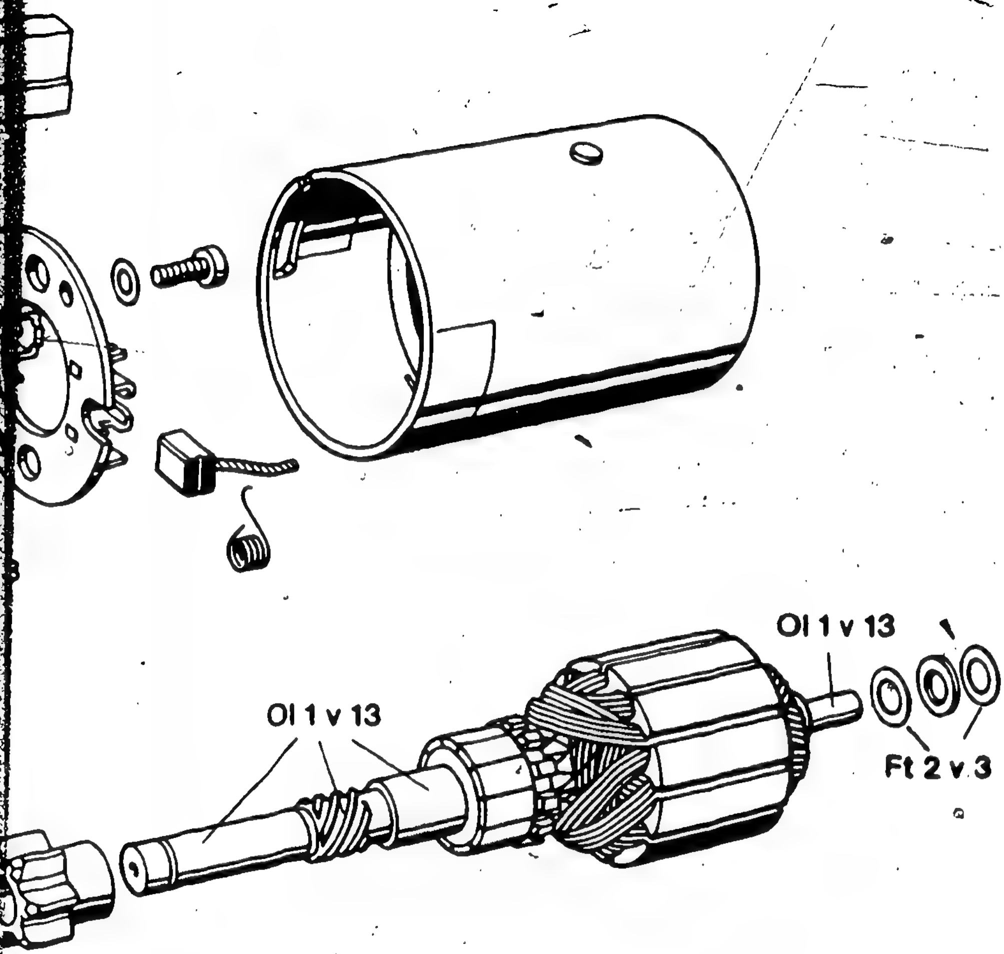
4.12

5.1.4 0 001 000 .. (CB 12 V 0.15 PS)



i5 13

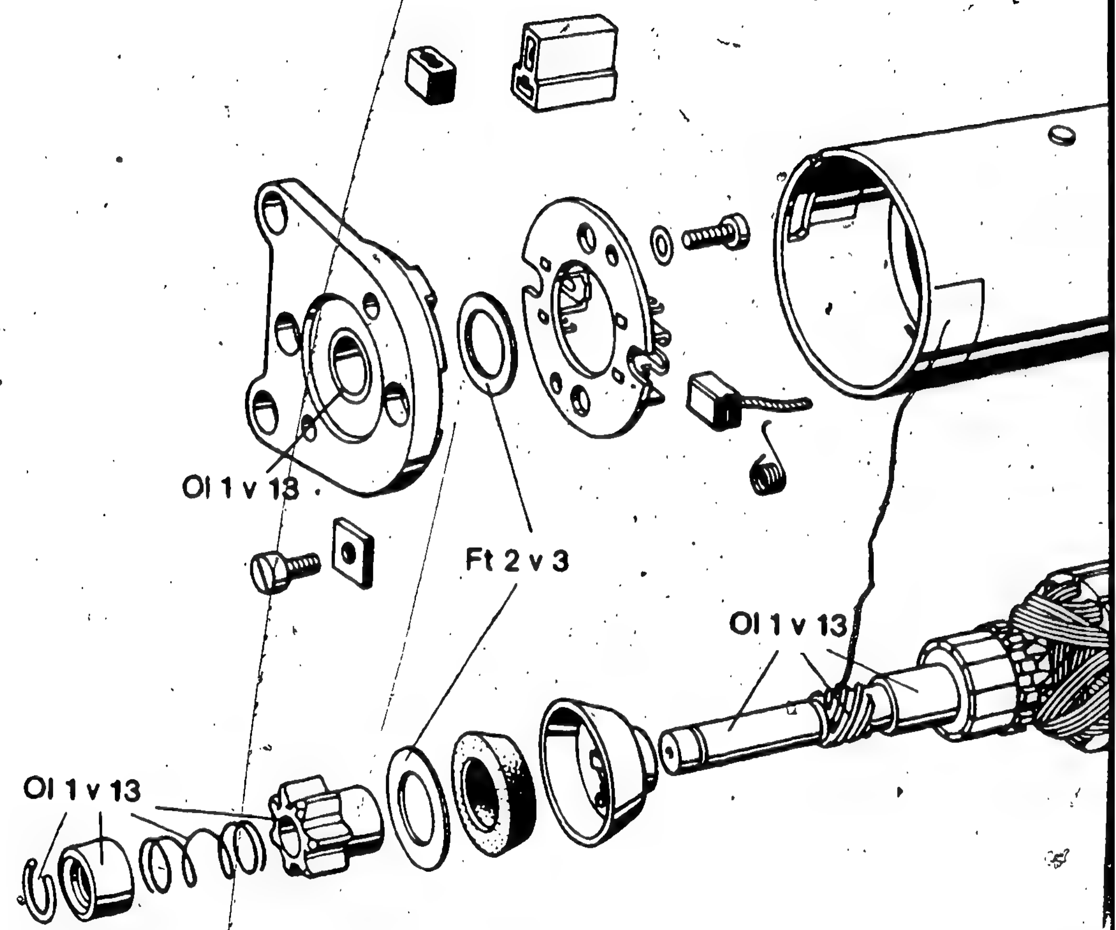
.15 PS)



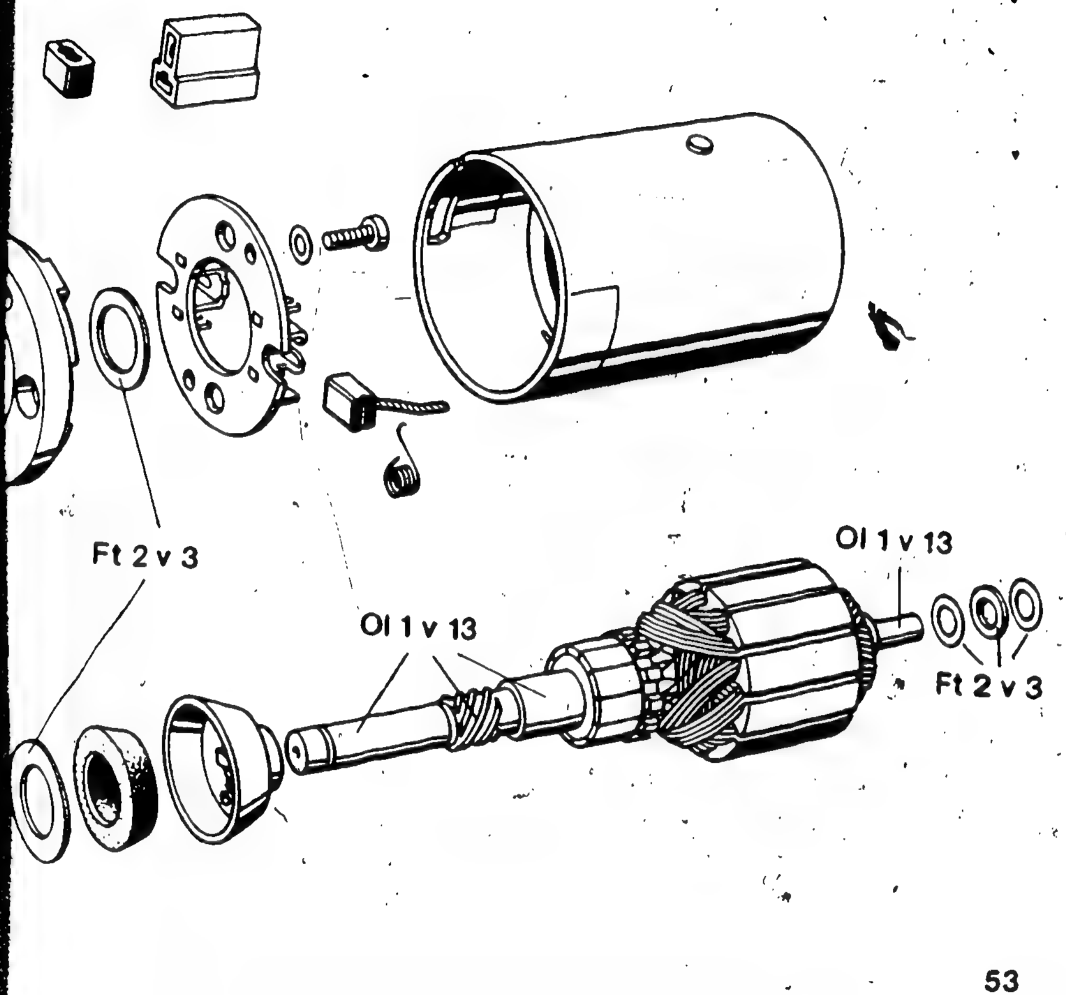
52

5 14

5.1.5 0 001 050 .. (CB 12 V 0.15 PS)



12 V 0.15 PS)



5.2 0 001 001 .. (CB 12 V 0.3 PS)

5.2.1 Mechanical test specifications (without relay)

Brush pressure	N	4.9 ... 5.9
Min. carbon brush length	mm	5
Setting "a" relay	mm	–
Burn-off reserve	mm	–
Armature longitudinal clearance	mm	0.01 ... 0.2
Armature braking torque	Ncm	5 ... 10
Overrunning torque overrunning clutch	Ncm	13 ... 18
Commutator dimension (new)	mm dia.	23
Minimum dimension	mm dia.	22.5

5.2.2 Electrical and functional test as
0 001 000 .. (CB 12 V 0.15 PS)
.. 050 .. (CB 12 V 0.15 PS)

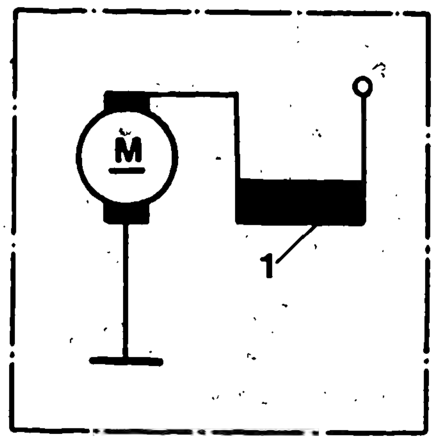
Only use prescribed batteries:

12 V 24 Ah or 12 V 18 Ah, semi-charged

5/17

Seite 20

5.2.3 Diagram

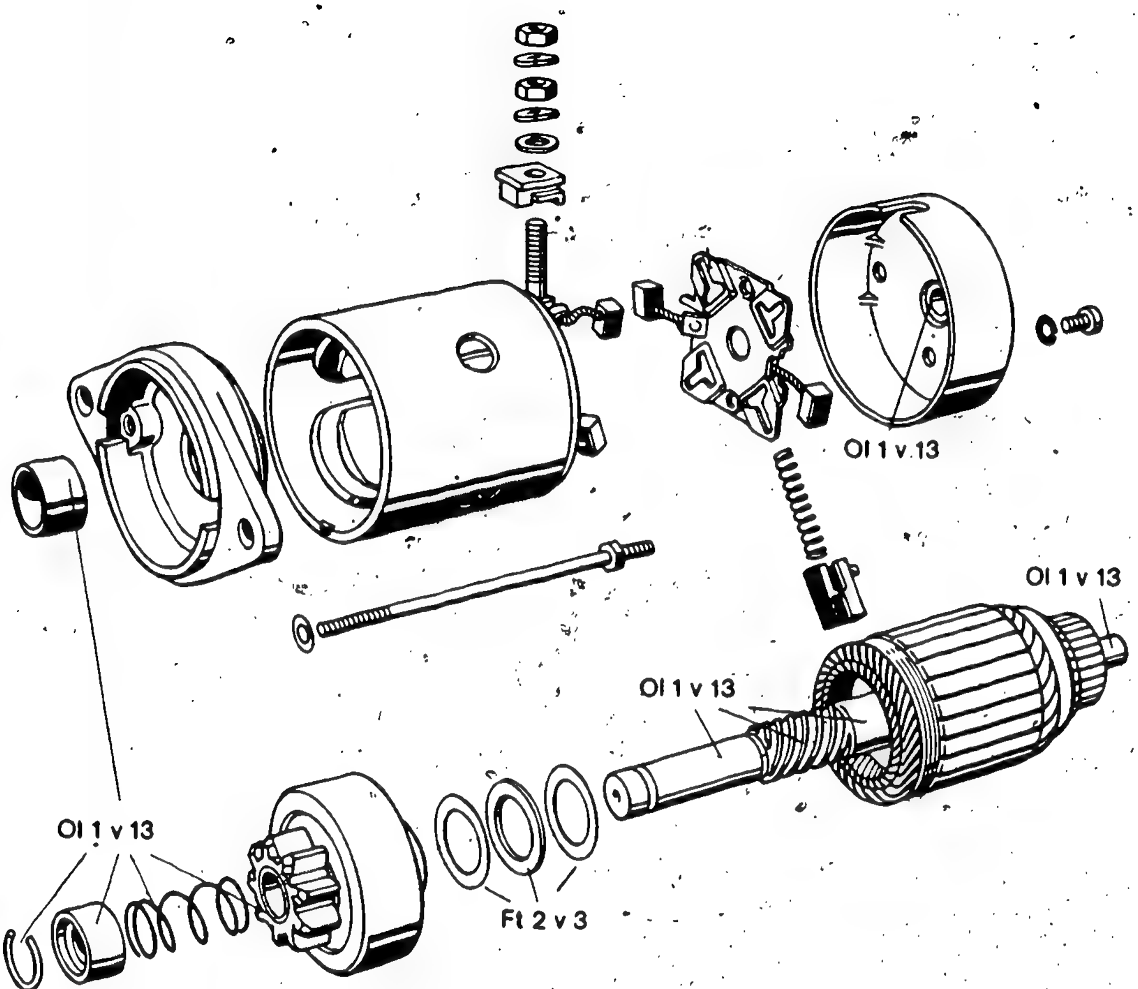


54

1 Series winding

J 18

5.2.4 0 001 001 .. (CB 12 V 0.3 PS)



55

5.3
0 001 155 .. (DD 12 V 0.5 PS) (relay 0 331 301 ..)

5.3.1 Mechanical test specifications

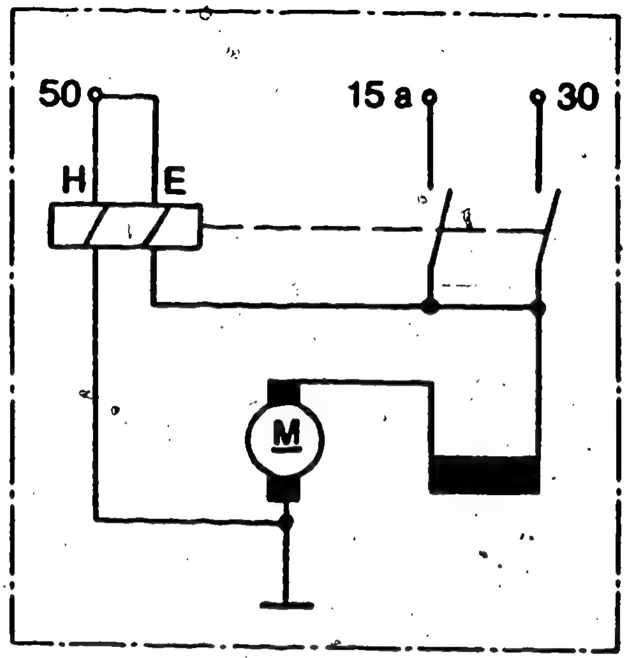
Brush pressure	N	8 ... 9
Min. carbon brush length	mm	11.5
Setting "a" relay	mm	29 ± 0.1
Burn-off reserve	mm	0.9 ... 1.5
Armature longitudinal clearance	mm	0.1 ... 0.3
Armature braking torque	Ncm	24 ... 40
Overrunning torque overrunning clutch	Ncm	13 ... 18
Commutator dimension (new)	mm dia.	33
Minimum dimension	mm dia.	31.2

F28 5.20

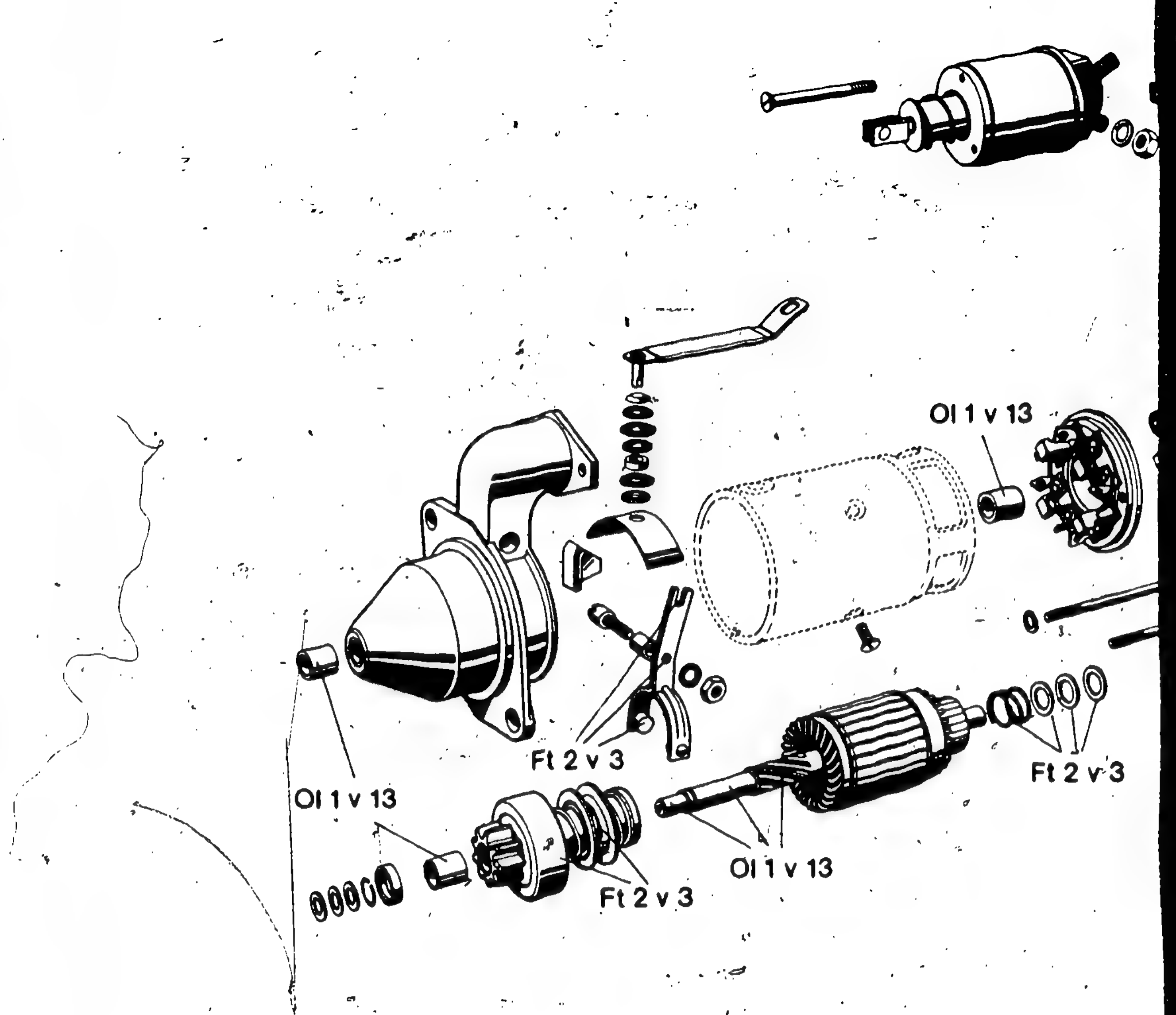
Seite 22

5.3.2 Diagram

Pre-engaged-drive starting motor with terminal 15a (16)

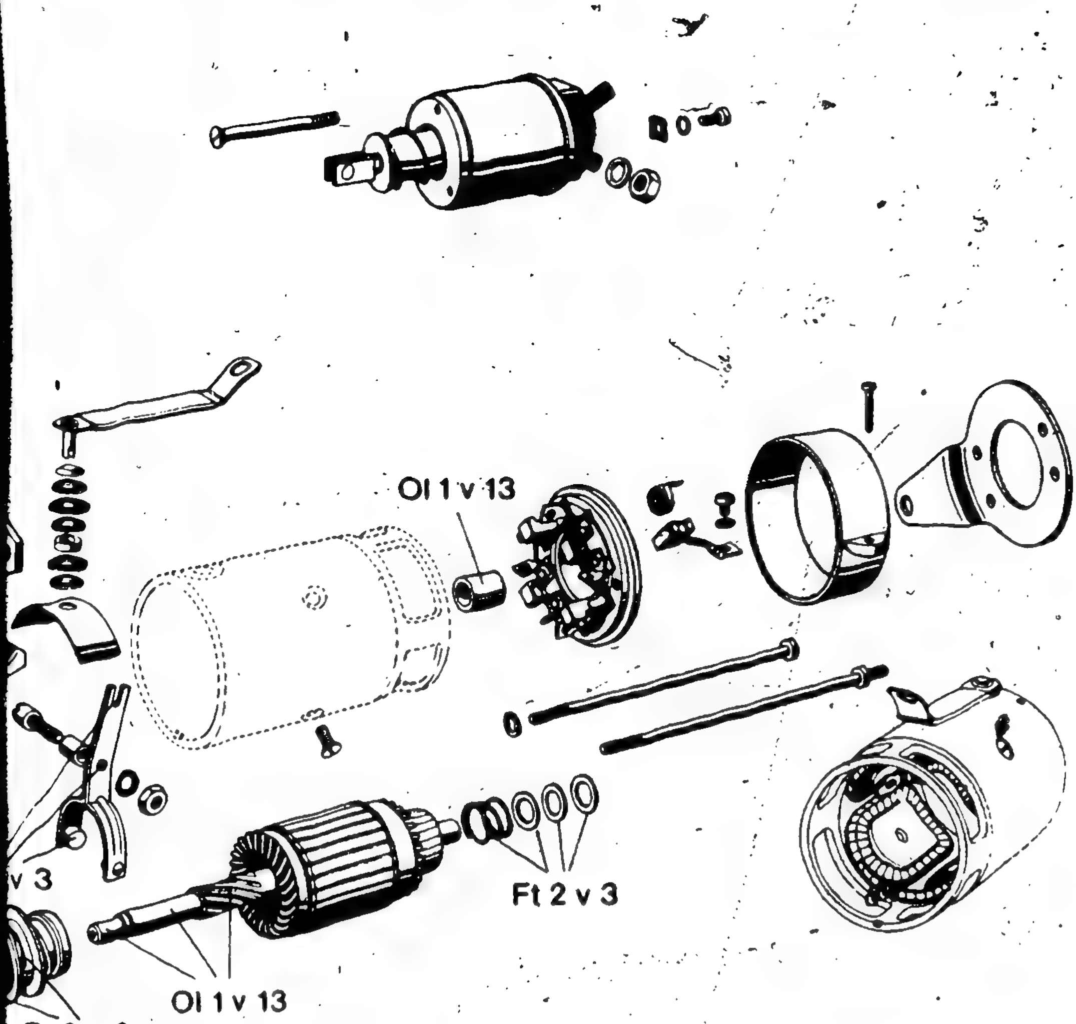


M 21



 5 22

12 V 0.5 PS)



M23

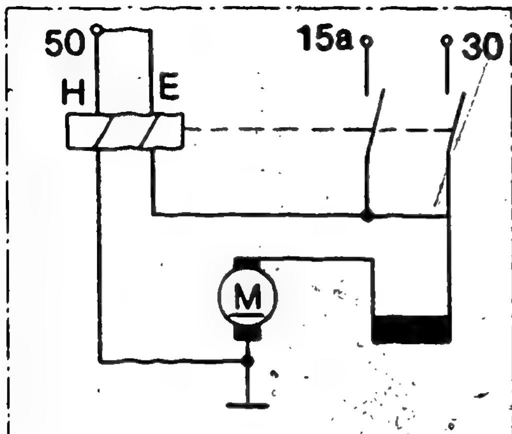
5.4
0 001 157 .. (DF 12 V 0.7 kW)

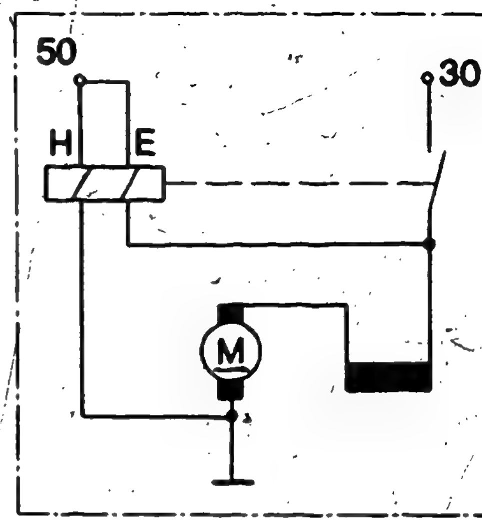
5.4.1 Mechanical test specifications

		up to 0 001 157 008	as of 0 001 157 009
Brush pressure	N	8 ... 9	14.5 ... 18.0
Min. carbon brush length	mm	11.5	11.5
Setting "a" relay	mm	–	–
Burn-off reserve	mm	0.7 ... 1.5	0.7 ... 1.5
Armature longitudinal clearance	mm	0.05 ... 0.25	0.05 ... 0.25
Armature braking torque	Ncm	24 ... 40	24 ... 40
Overrunning torque overrunning clutch	Ncm	14 ... 22	14 ... 22
Commutator dimension (new)	mm dia.		33
Minimum dimension	mm dia.	–	31.2
Tightening torque of pole shoe screws	Nm	20 ... 28	

5 24

5.4.2 Diagram





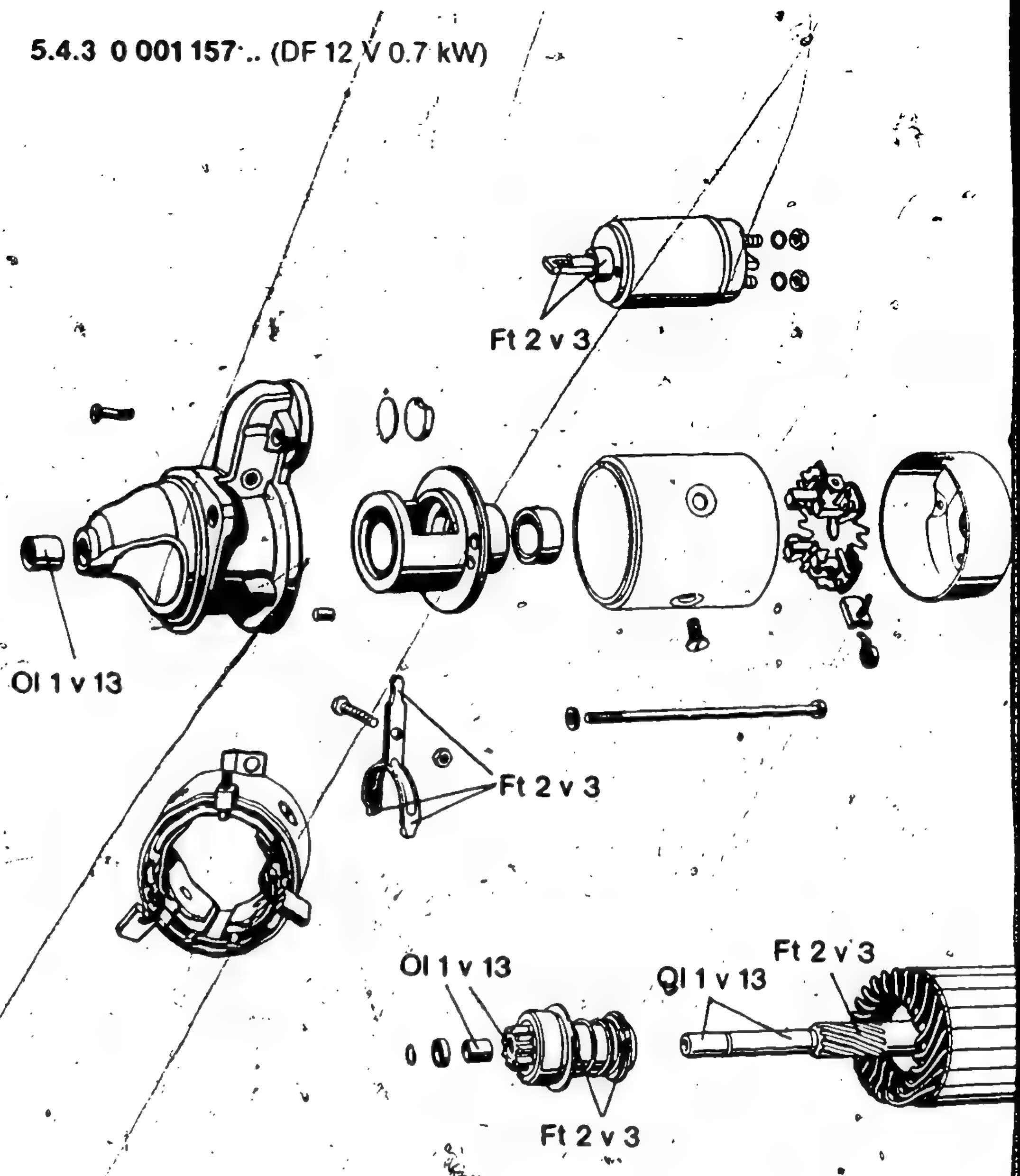
58

Starting motor with terminal 15a

Starting motor without terminal 15a

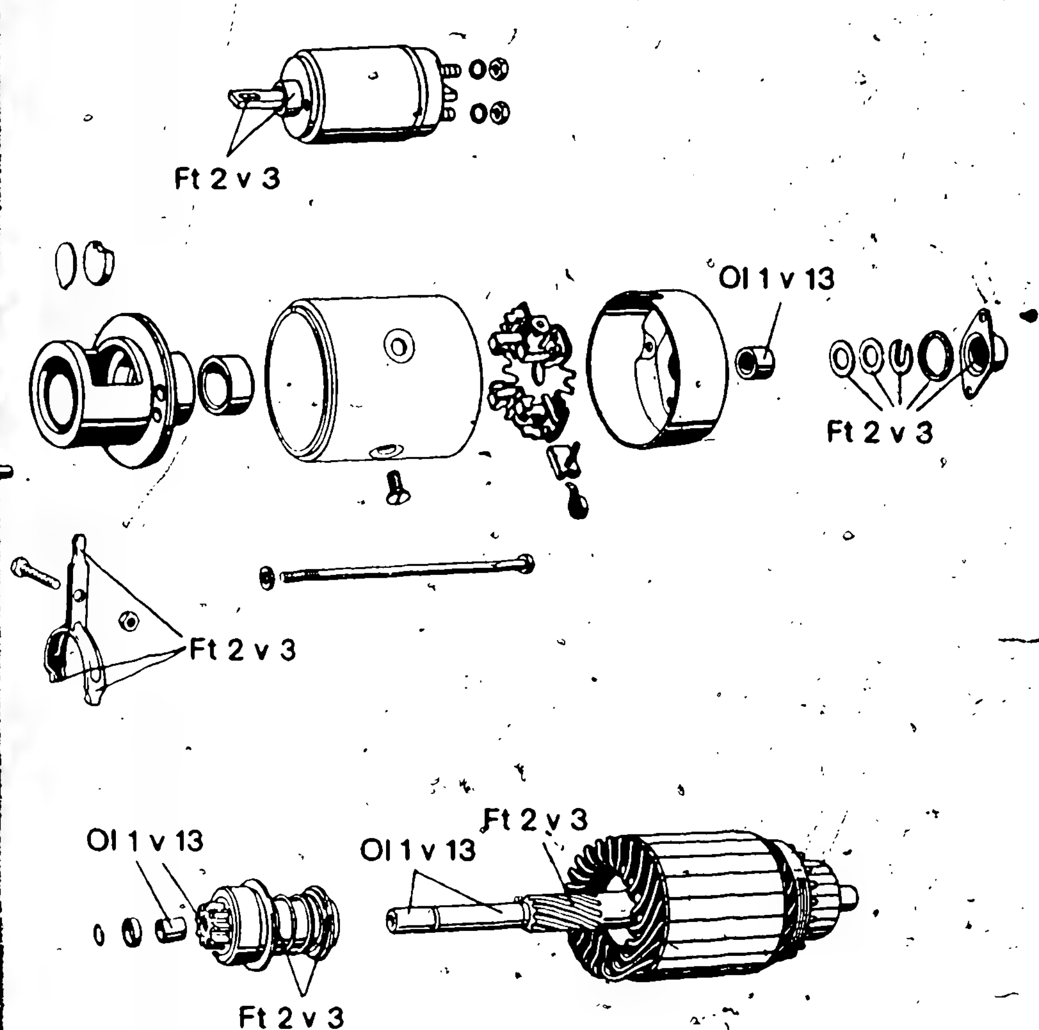
5 25

5.4.3 0 001 157·.. (DF 12 V 0.7 kW)



5 26

5 27



59

5 27

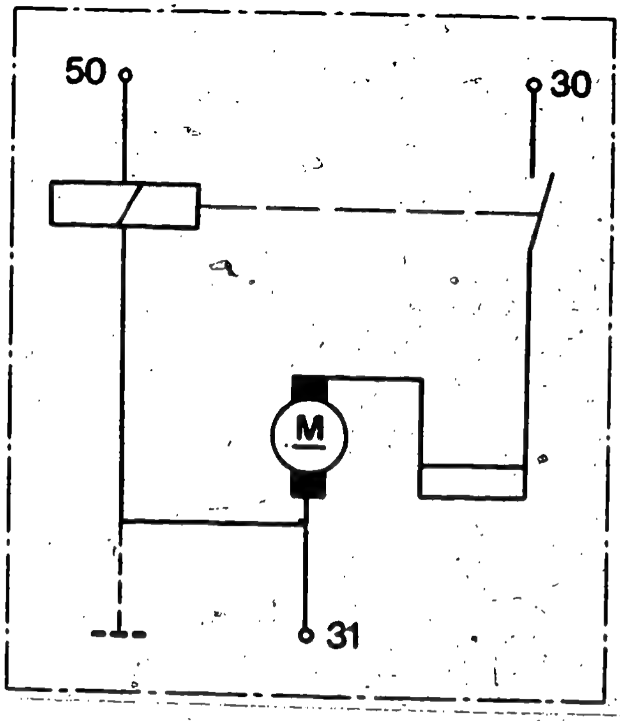
5.5
0 001 160 .. (DG 12 V 0.4 PS)

5.5.1 Mechanical test specifications

Brush pressure	N	7.5 ... 16
Min. carbon brush length	mm	11.5
Setting "a" relay	mm	–
Burn-off reserve	mm	–
Armature longitudinal clearance	mm	0.05 ... 0.2
Armature braking torque	Ncm	12 ... 17
Overrunning torque overrunning clutch	Ncm	13 ... 18
Commutator dimension (new)	mm dia.	31.7
Minimum dimension	mm dia.	31.2

5 28

5.5.2 Diagram

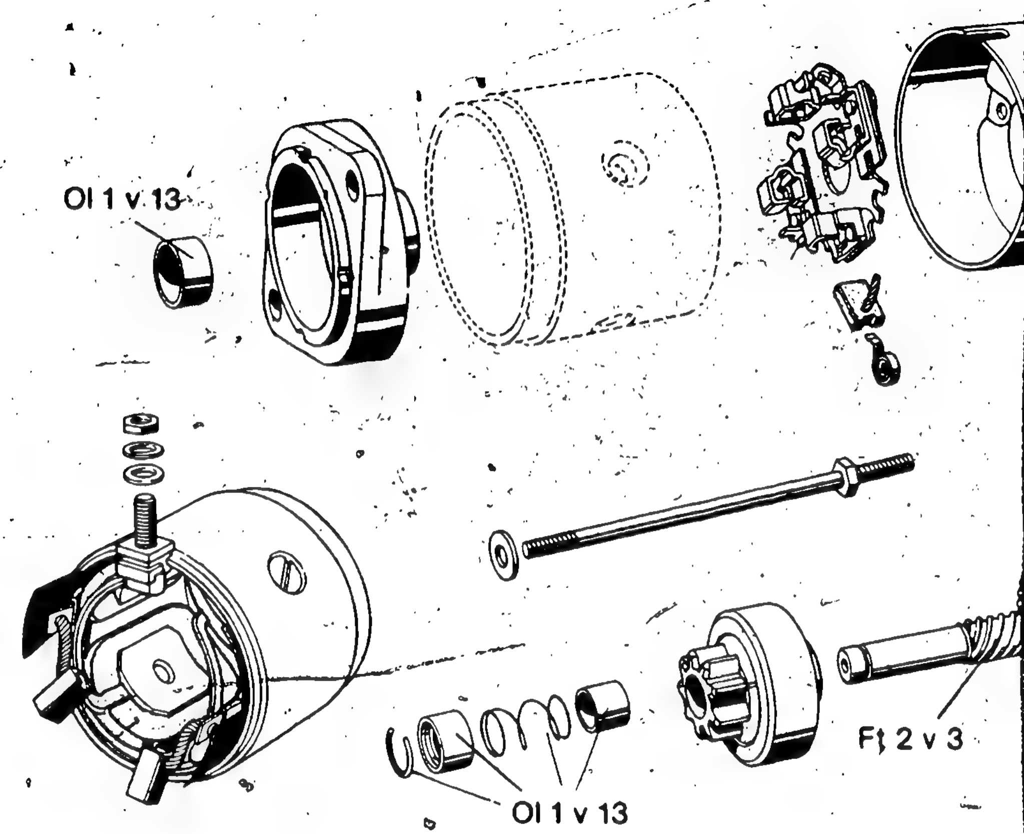


60

Starting motor versions with and without terminal 31

K1

5.5.3 0 001 160 .. (DG 12 V 0.4 PS)

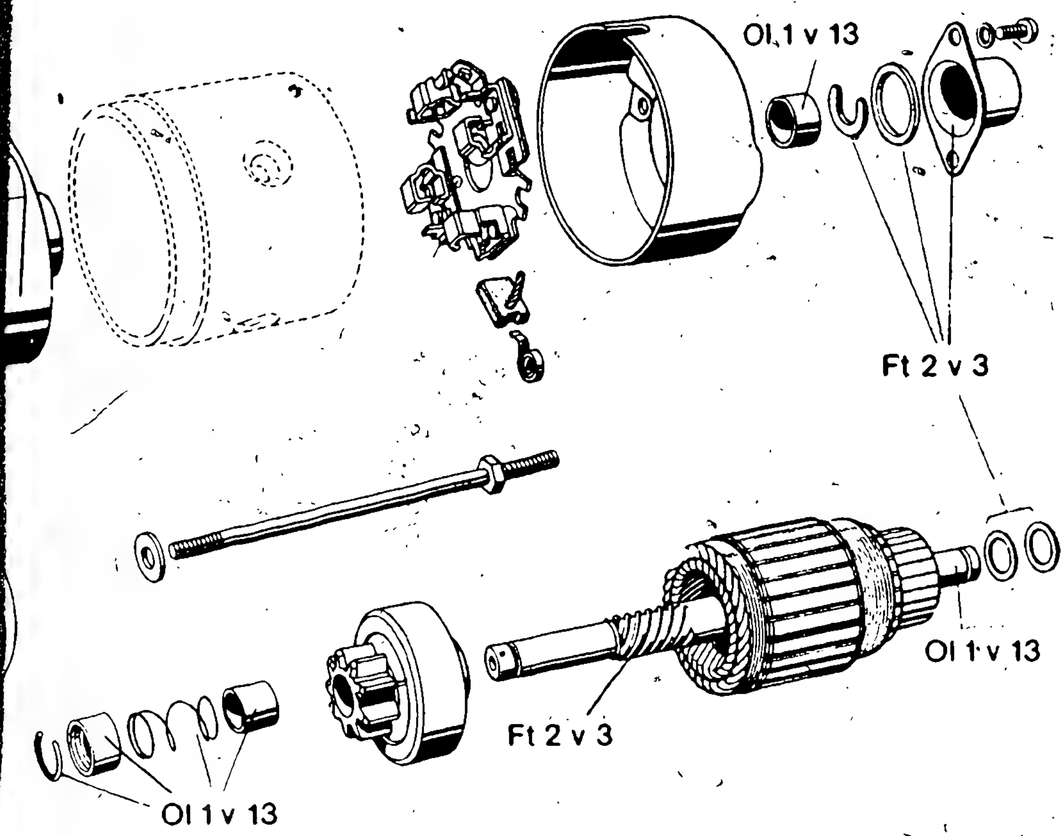


Eas 42

43

K2

2 V 0.4 PS)



4 3

5.6 001 207 .. (EF 6 V 0.5 PS)*
.. 208 .. (EF 12 V 0.8 PS)
.. 209 .. (EF 12 V 0.7 PS)
.. 211 .. (EF 12 V 0.7 PS)
.. 214 .. (EF 12 V 0.7 PS)

5.6.1 Mechanical test specifications

		.. 207 .. EF 6 V 0.5 PS	.. 208 .. 12 V 0.8 PS
Brush pressure	N	11.5–13	11.5–13.5
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	19 ± 0.15	–
Burn-off reserve	mm	0.7–1.5	0.7–1.5
Armature longitudinal clearance	mm	0.05–0.3	0.01–0.3
Armature braking torque	Ncm	25–40	22–40[1]
Overrunning torque overrunning clutch	Ncm	13–18	13–18
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

		.. 208 051 to 058 12 V 0.8 PS	.. 209 .. 6 V 0.45 PS
Brush pressure	N	11.5–13	11.5–13
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	–	–
Burn-off reserve	mm	0.7–1.5	0.7–1.5
Armature longitudinal clearance	mm	0.05–0.3	0.05–0.3
Armature braking torque	Ncm	25–40	25–40
Overrunning torque overrunning clutch	Ncm	14–22	13–18
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

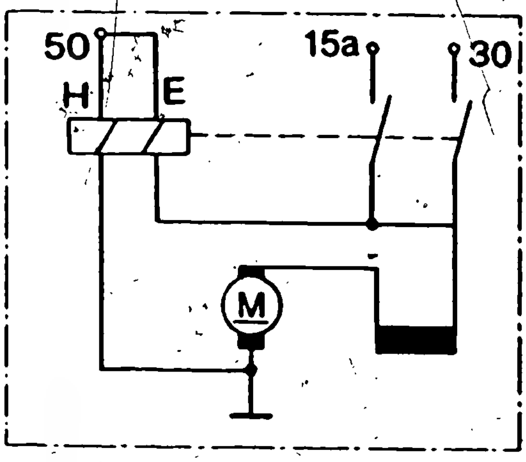
44

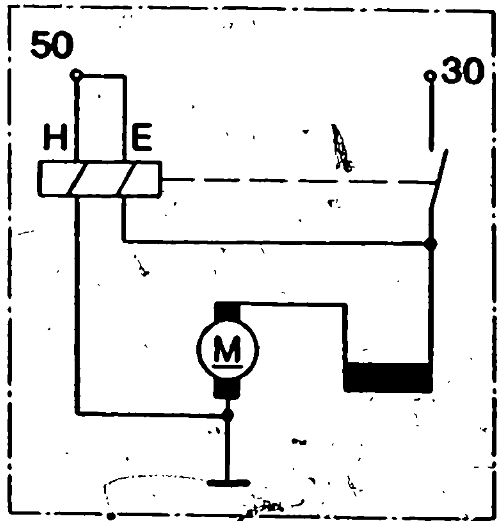
		.. 211 .. 12 V 0.7 PS	.. 211 9 .. 12 V 0.7 PS
Brush pressure	N	11.5–13	10.8–12.2
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	–	–
Burn-off reserve	mm	0.7–1.5	0.7–1.5
Armature longitudinal clearance	mm	0.01–0.15	0.01–0.3
Armature braking torque	Ncm	25–40	25–40
Overrunning torque overrunning clutch	Ncm	14–22	14–22
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

		.. 211 2 .. 12 V 0.7 PS	.. 214 .. 12 V 0.7 PS
Brush pressure	N	11.5 .. 13	11.5–13
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	–	–
Burn-off reserve	mm	0.7 .. 1.5	0.7–1.5
Armature longitudinal clearance	mm	0.01 .. 0.15	0.1–0.3
Armature braking torque	Ncm	25 .. 40	35–50
Overrunning torque overrunning clutch	Ncm	14 .. 22	18–25
Commutator dimension (new)	mm dia.	35.3	36
Minimum dimension	mm dia.	32.8	33.5

Tightening torque for pole shoe screws of EF starting motors generally 21 .. 30 Nm

5.6.2 Diagrams





62

Starting motor with terminal 15a

Starting motor without terminal 15a

5.7 0 001 212 .. (EB 12 V 0.8 kW)
.. 213 .. (EB 6 V 0.5 PS)
.. 215 .. (EB 12 V 1.3 PS)
.. 312 .. (GB 12 V 1.5 kW)
.. 356 .. (JB 12 V 1.8 PS)
.. 357 .. (JB 12 V 2.5 PS)

5.7.1 Mechanical test specifications

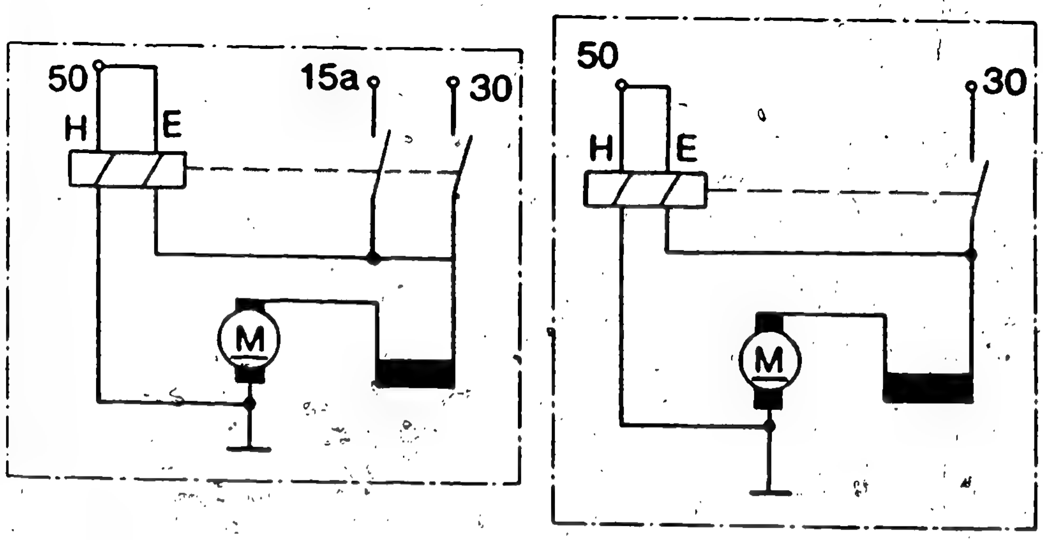
		.. 212 .. (EB 12 V 0.8 PS)	.. 213 .. (EB 6 V 0.5 PS)
Brush pressure	N	10.8–12.2	11.5–13
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	–	–
Burn-off reserve	mm	0.7–1.5	0.7–1.5
Armature longitudinal clearance	mm	0.01–0.3	0.1–0.3
Armature braking torque	Ncm	35–50	35–50
Overrunning torque overrunning clutch	Ncm	18–25	18–25
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

		.. 215 .. (EB 12 V 1.3 PS)
Brush pressure	N	11.5–13
Min. carbon brush length	mm	13
Setting "a" relay	mm	–
Burn-off reserve	mm	0.7–1.5
Armature longitudinal clearance	mm	0.1–0.3
Armature braking torque	Ncm	35–50
Overrunning torque overrunning clutch	Ncm	18–25
Commutator dimension (new)	mm dia.	36
Minimum dimension	mm dia.	33.5

		.. 3121 .. (GB 12 V 1.5 kW, 1.4/1.5 PS)
Brush pressure	N	8–9
Min. carbon brush length	mm	10
Setting "a" relay	mm	31.6 ± 0.1
Burn-off reserve	mm	0.9–1.5
Armature longitudinal clearance	mm	0.1–0.3
Armature braking torque	Ncm	30–55
Overrunning torque overrunning clutch	Ncm	18–28
Commutator dimension (new)	mm dia.	36
Minimum dimension	mm dia.	33.5

		.. 356 .. (JB 12 V 1.8 PS) .. 357 .. (JB 12 V 2.5 PS)
Brush pressure	N	10–13
Min. carbon brush length	mm	15.5
Setting "a" relay	mm	
Burn-off reserve	mm	1.0–1.6
Armature longitudinal clearance	mm	0.1–0.3
Armature braking torque	Ncm	4.5–6.0
Overrunning torque overrunning clutch	Ncm	2.0–3.0
Commutator dimension (new)	mm dia.	42
Minimum dimension	mm dia.	39.5

5.7.2 Diagrams



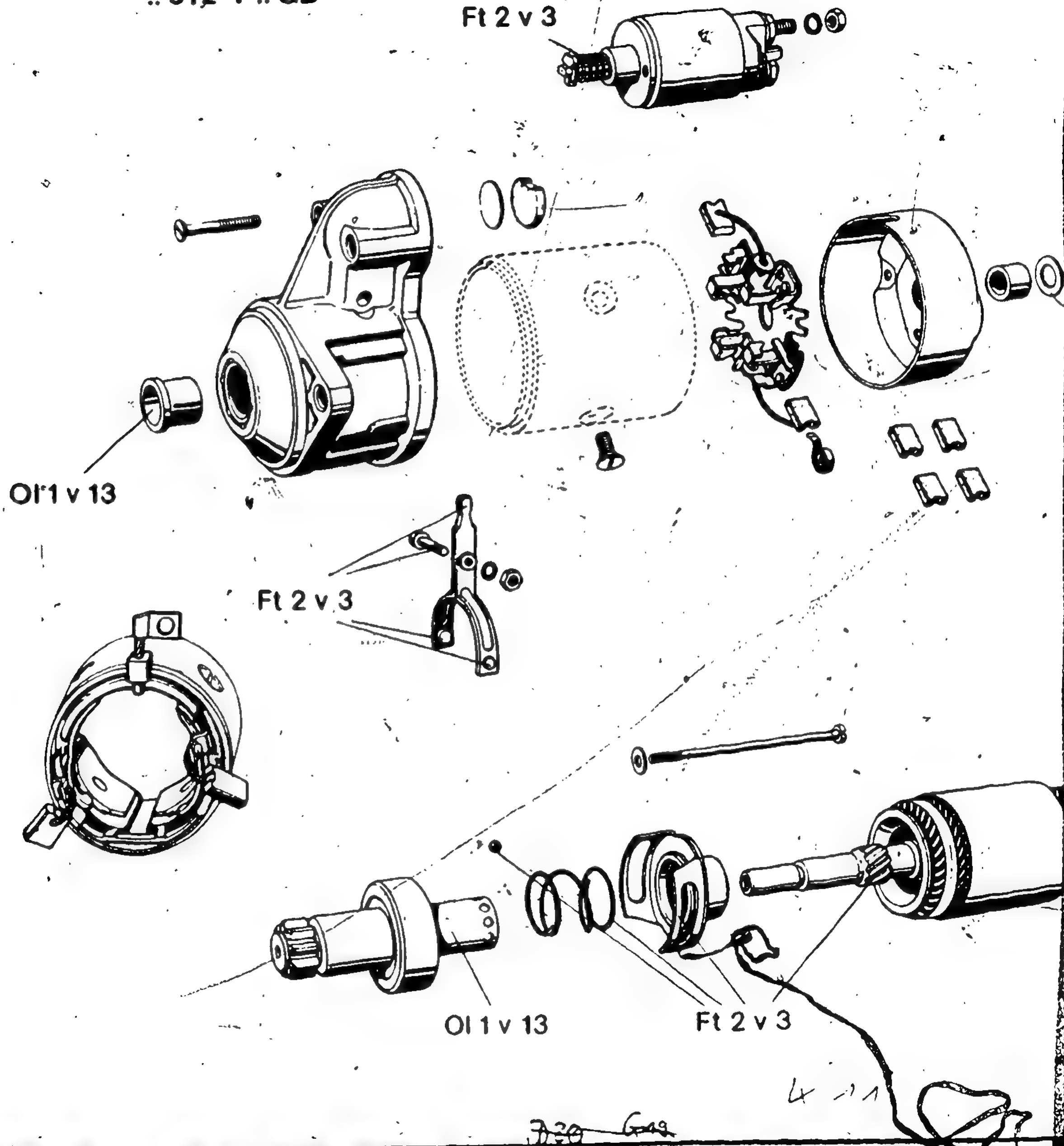
a) Starting motor with terminal 15a

b) Starting motor without terminal 15a

for 0 001 356 ..
and .. 357 .. only diagram b) applies

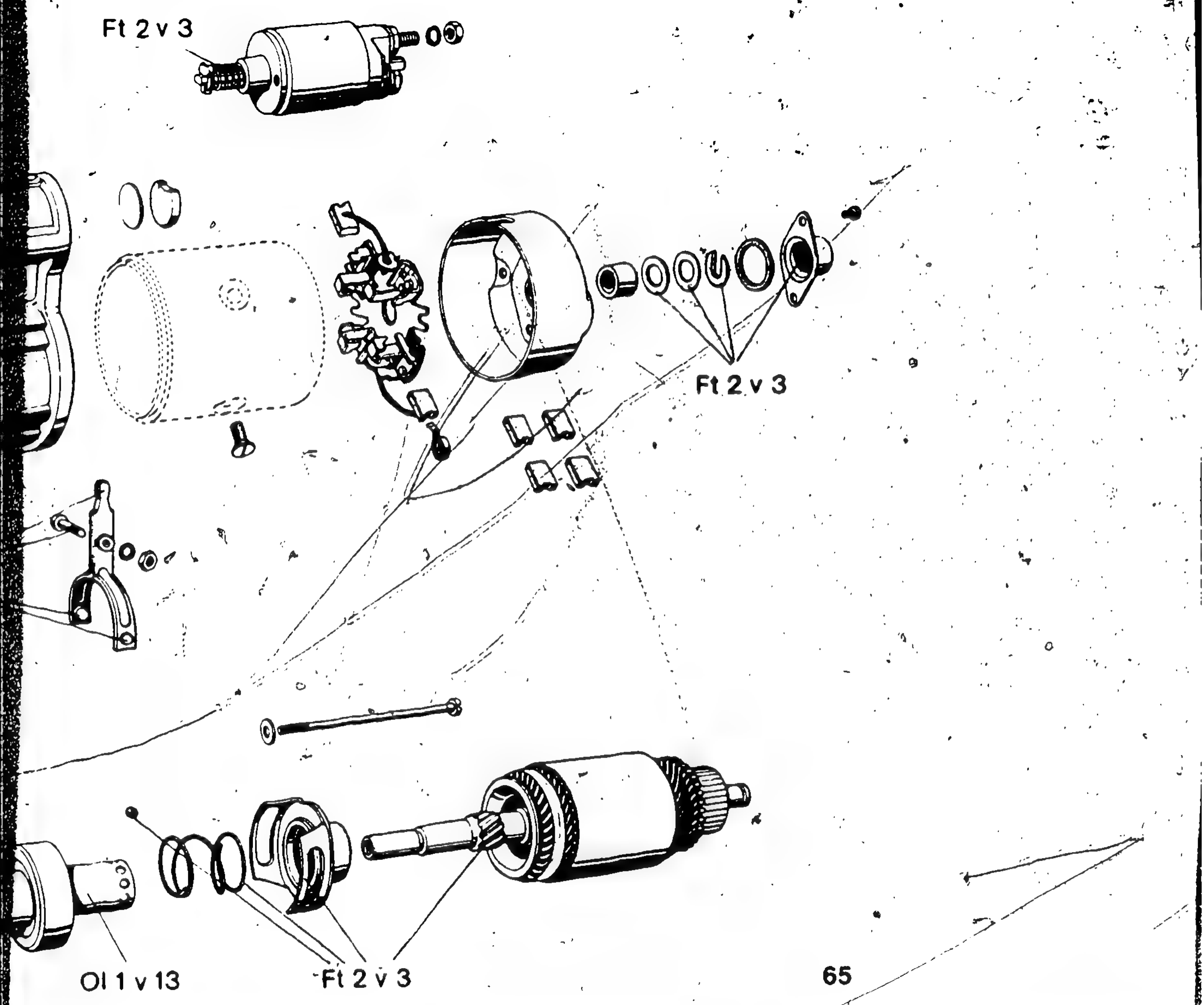
 49

5.7.3 0 001 212 .. EB
.. 213 ..
.. 213 ..
.. 215 ..
.. 312 1 .. GB



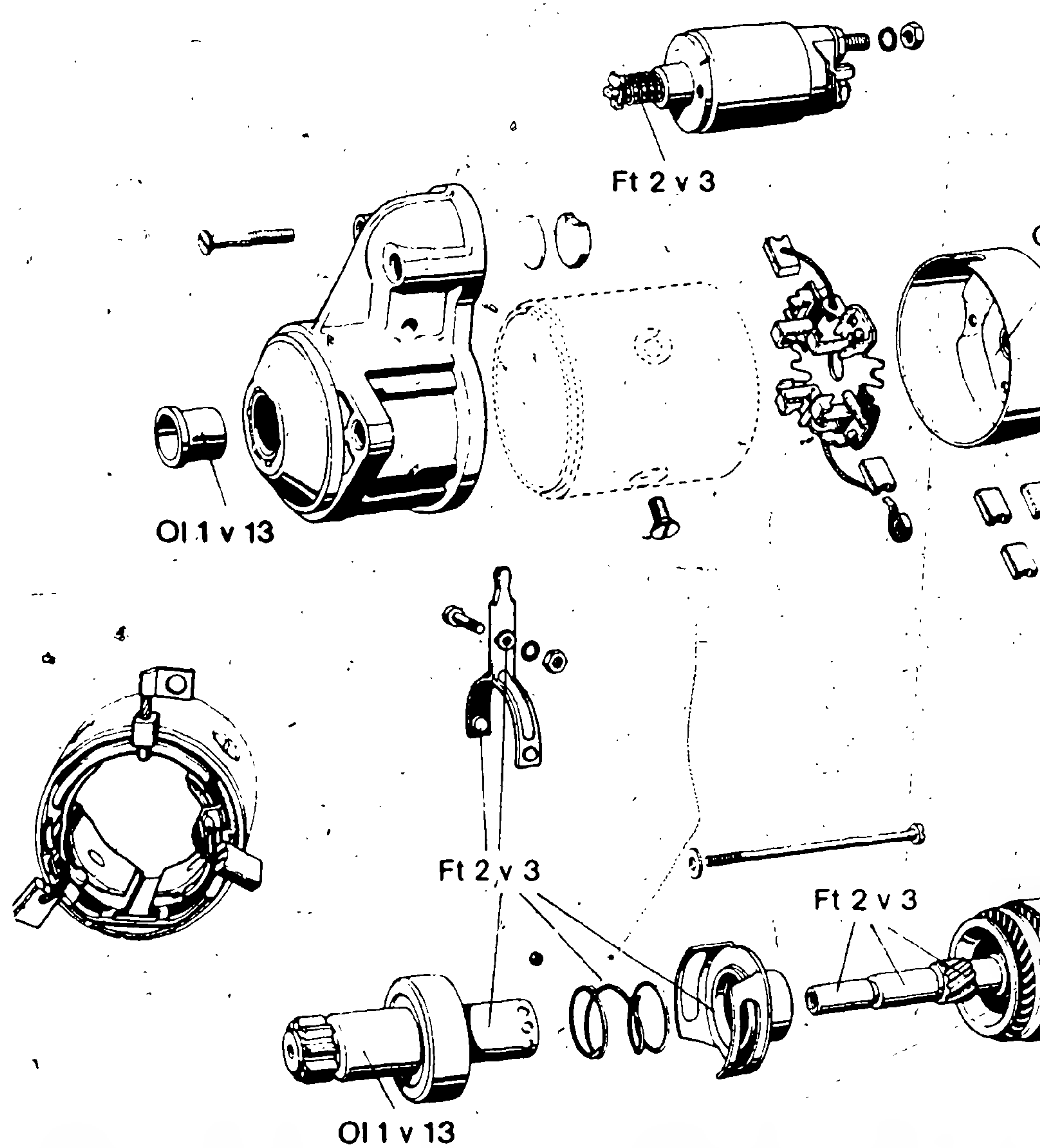
4 10

4 11



4 11

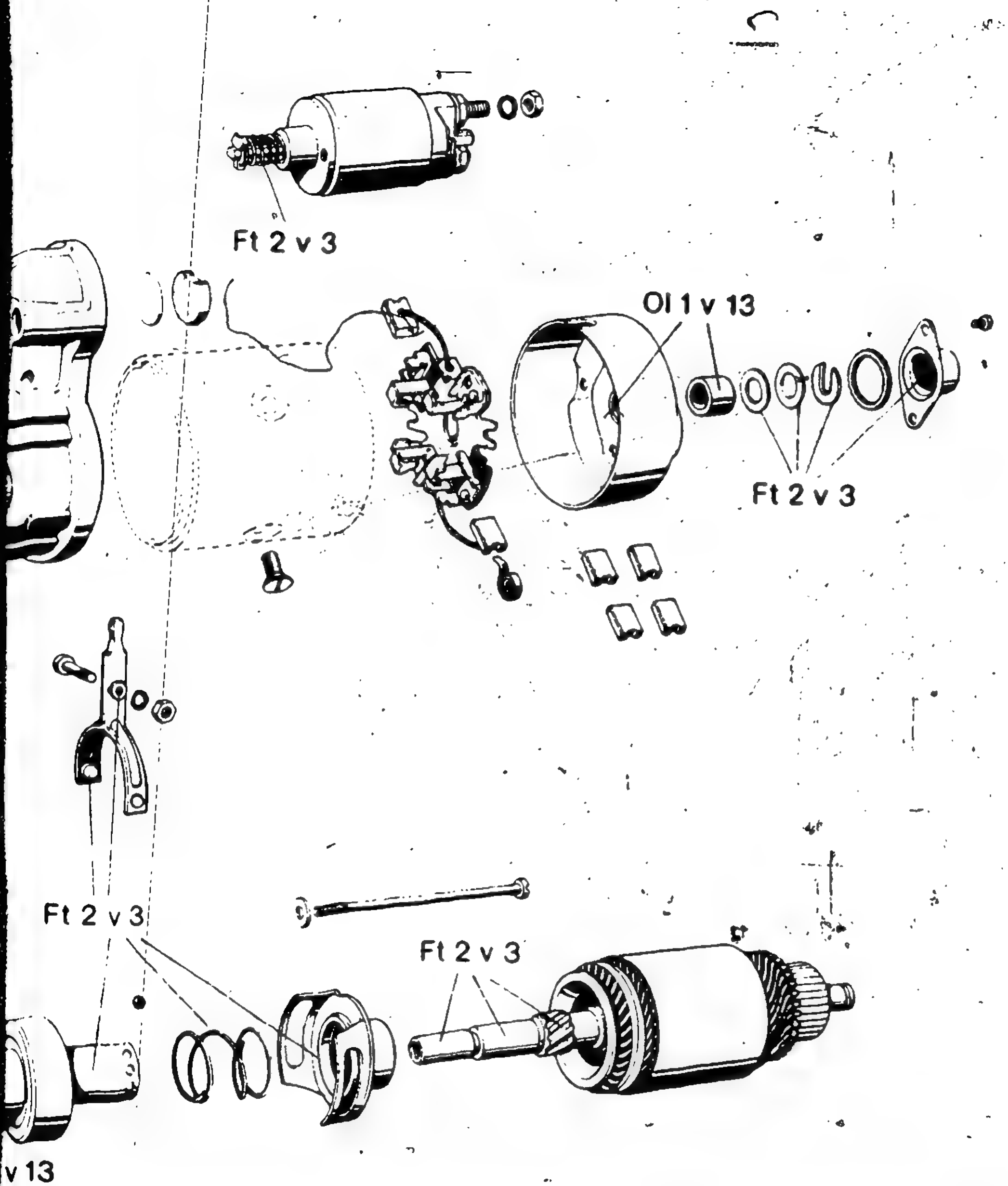
5.7.4 0 001 356 .. JB
357 .. JB



4; 12

L

K12



4 13

5.8
0 001 306 .. (GE 12 V 1 PS)
307 .. (GE 12 V 1.3 PS)
308 .. (GE 24 V 1 PS)
312 .. (GE 12 V 2 PS)

5.8.1 Mechanical test specifications

		.. 306 .. GE 12 V 1 PS	.. 307 .. .. 1.3 PS
Brush pressure	N	8–9	8–9
Min. carbon brush length	mm	10	10
Setting "a" relay	mm	32.2 ± 0.1	33.0 ± 0.1
Burn-off reserve	mm	0.9–1.5	0.9–1.5
Armature longitudinal clearance	mm	0.1–0.3	0.1–0.3
Armature braking torque	Ncm	30–50	30–50
Overrunning torque overrunning clutch	Ncm	13–18	26–32
Commutator dimension (new)	mm dia.	35.8	35.8
Minimum dimension	mm dia.	33.5	33.5

		.. 307 019	.. 308 .. GE 24 V 1 PS
Brush pressure	N	8–9	8–9
Min. carbon brush length	mm	10	10
Setting "a" relay	mm	34.0 ± 0.1	32.2 ± 0.1
Burn-off reserve	mm	0.9–1.6	0.9–1.5
Armature longitudinal clearance	mm	0.1–0.3	0.1–0.3
Armature braking torque	Ncm	30–50	30–50
Overrunning torque overrunning clutch	Ncm	26–32	13–18
Commutator dimension (new)	mm dia.	35.8	35.8
Minimum dimension	mm dia.	33.5	33.5

G22 K 14

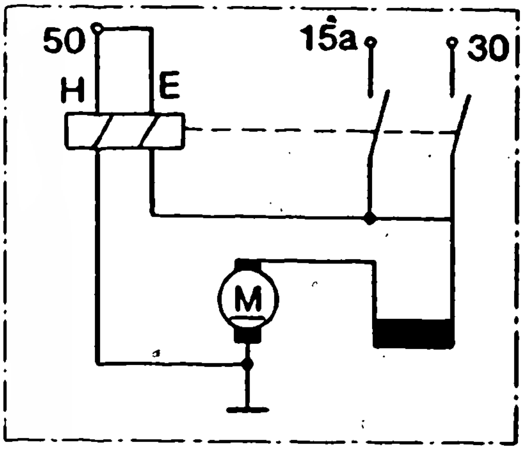
		.. 308 1 ..	.. 312 0 .. GE 12V 2 PS
Brush pressure	N	8–9	8–9
Min. carbon brush length	mm	10	10
Setting "a" relay	mm	34 ± 1	31.6–0.1
Burn-off reserve	mm	0.7–1.5	0.9–1.5
Armature longitudinal clearance	mm	0.05–0.3	0.1–0.3
Armature braking torque	Ncm	30–50	30–50
Overrunning torque overrunning clutch	Ncm	28–40	13–18
Commutator dimension (new)	mm dia.	35.8	35.8
Minimum dimension	mm dia.	33.5	33.5

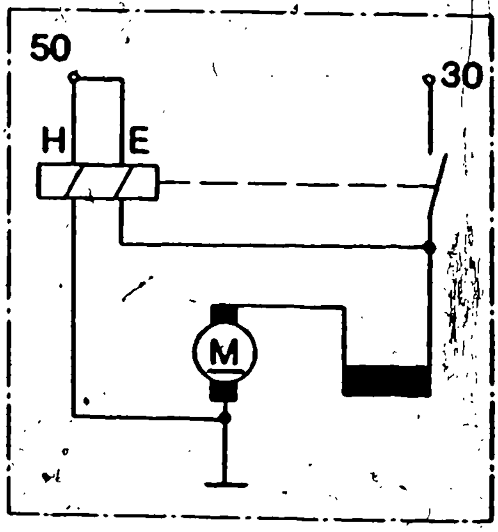
4 15

K15

G 23

5.8.2 Diagrams





67

Starting motor with terminal 15a

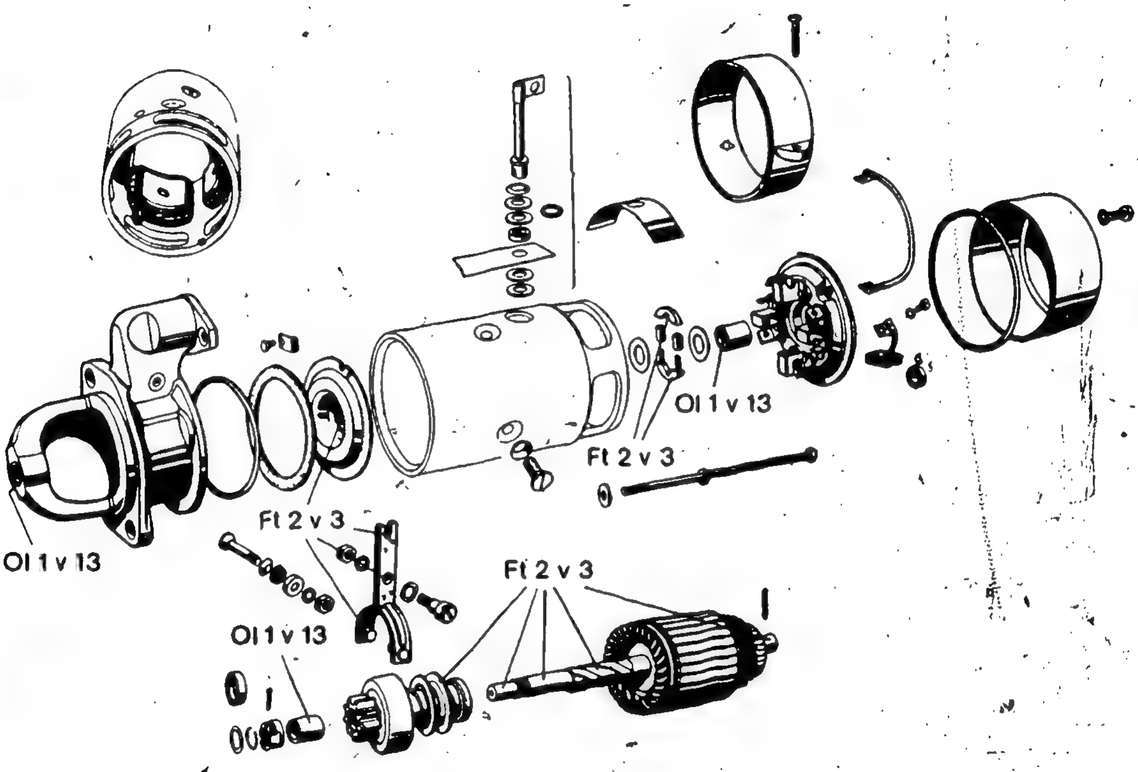
Starting motor without terminal 15a

4 16

G 26

W-001/103
Seite 29

5.8.3 0 001 306 GE 12 V 1 PS
.. 307 .. GE 12 V 1.3 PS
.. 308 .. GE 24 V 1 PS
GE 12 V 2 PS



68

K17

5.9

0 001 310 ..	GF 6 V 0.6 PS
.. 311 003	GF 12 V 1.0 PS (1.35 kW)
.. 311 042	GF 12 V 1.1 PS
.. 311 1 ..	GF 12 V 1.2 PS
.. 313 ..	GF 12 V 1.1 PS
.. 314 ..	GF 12 V 1.5 PS (1.5 kW)
.. 315 ..	GF 12 V 2.0 PS (1.9 kW)

5.9.1 Mechanical test specifications

		.. 310 .. GF 6 V 0.6 PS	.. 311 .. 12 V 1 PS
Brush pressure	N	11.5–13	11.5–13
Min. carbon brush length	mm	13	10
Setting "a" relay	mm	19.0 ± 0.1	19.0 ± 0.1
Burn-off reserve	mm	0.7–1.5	0.7–1.5
Armature longitudinal clearance	mm	0.05–0.3	0.05–0.3
Armature braking torque	Ncm	25–40	25–40
Overrunning torque overrunning clutch	Ncm	13–18	13–18
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

		.. 311 033 12 V 1.1 PS	.. 311 042 12 V 1.2 PS
Brush pressure	N	11.5–13	11.5–13
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	19.0 ± 0.1	19.0 ± 0.1
Burn-off reserve	mm	0.7–1.5	0.7–1.5
Armature longitudinal clearance	mm	0.05–0.3	0.01–0.3
Armature braking torque	Ncm	22–40	30–55
Overrunning torque overrunning clutch	Ncm	13–18	14–22
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

K 18

		.. 311 1 .. 12 V 1.1 PS	.. 313 .. 12 V 1.4 PS
Brush pressure	N	14–16	11.5–13
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	16.0 ± 0.1	19.0 ± 0.1
Burn-off reserve	mm	0.7–1.5	0.7–1.5
Armature longitudinal clearance	mm	0.01–0.3	0.05–0.2
Armature braking torque	Ncm	25–40	18–40
Overrunning torque overrunning clutch	Ncm	14–22	13–18
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

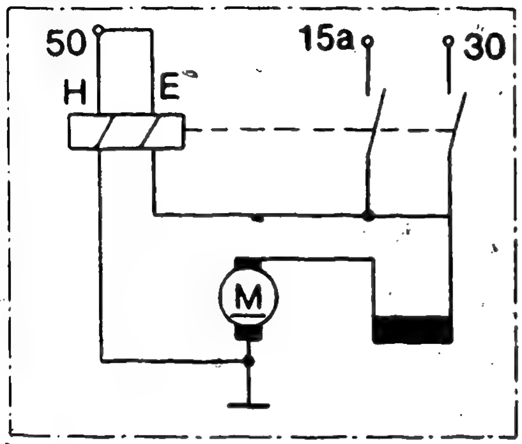
		.. 314 .. 12 V 1.5 PS	.. 315 .. 12 V 2 PS
Brush pressure	N	11.5 .. 13	11.5–13
Min. carbon brush length	mm	13	13
Setting "a" relay	mm	18.9 .. 19.1	–
Burn-off reserve	mm	0.7 .. 1.5	0.7–1.5
Armature longitudinal clearance	mm	0.05 .. 0.2	0.05–0.3
Armature braking torque	Ncm	30–55	20–55
Overrunning torque overrunning clutch	Ncm	14–22	14–22
Commutator dimension (new)	mm dia.	36	36
Minimum dimension	mm dia.	33.5	33.5

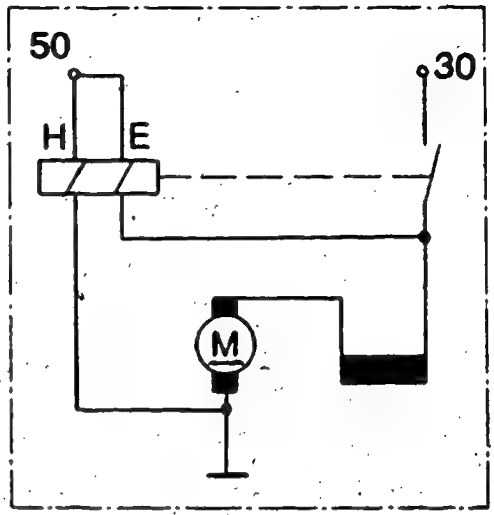
Tightening torque of pole shoe screws Nm 37 .. 53

K19 K19

Seite 30

5.9.2 Diagrams





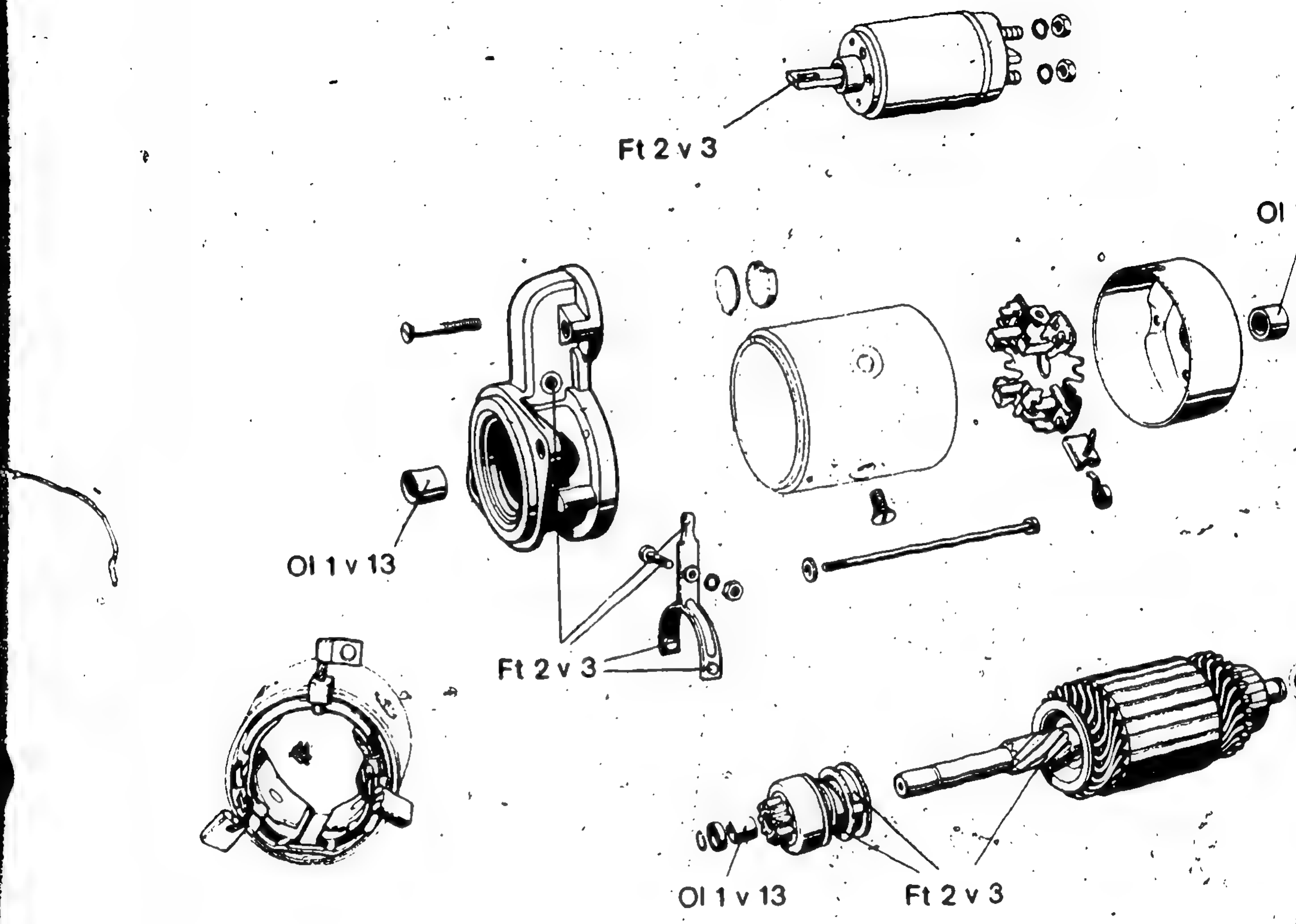
69

Starting motor with terminal 15a

Starting motor without terminal 15a

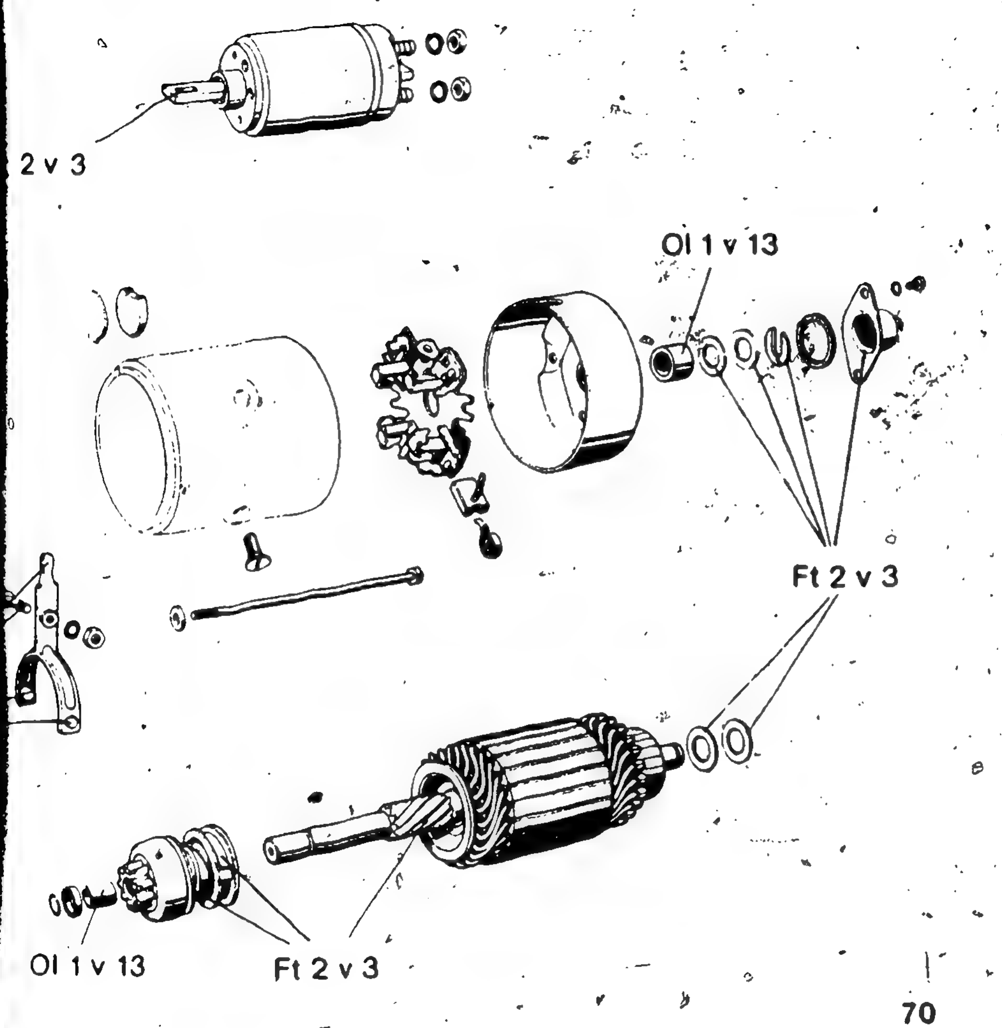
4 20

5.9.3 0 001 310 .. GF



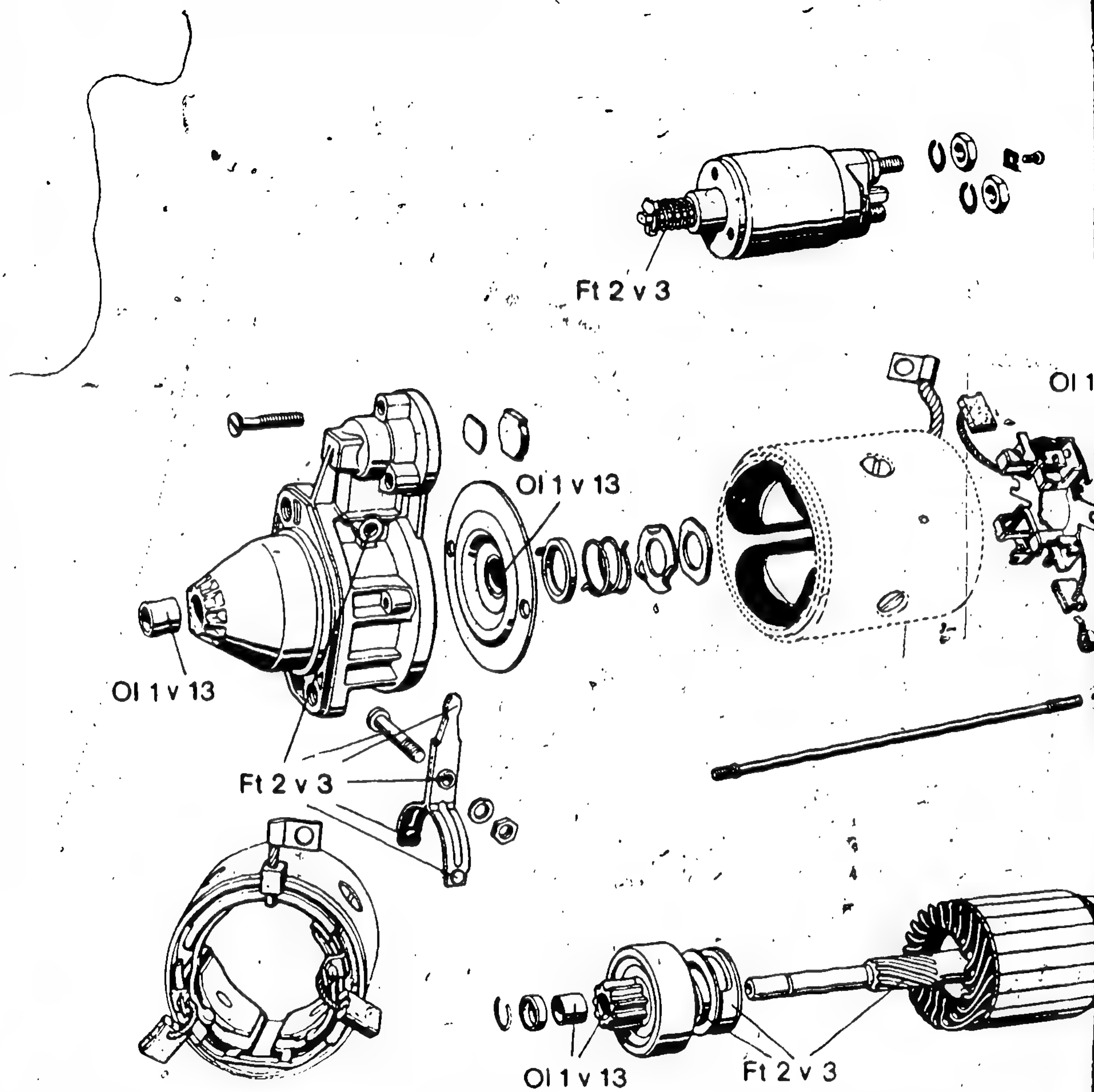
4 21

4 22



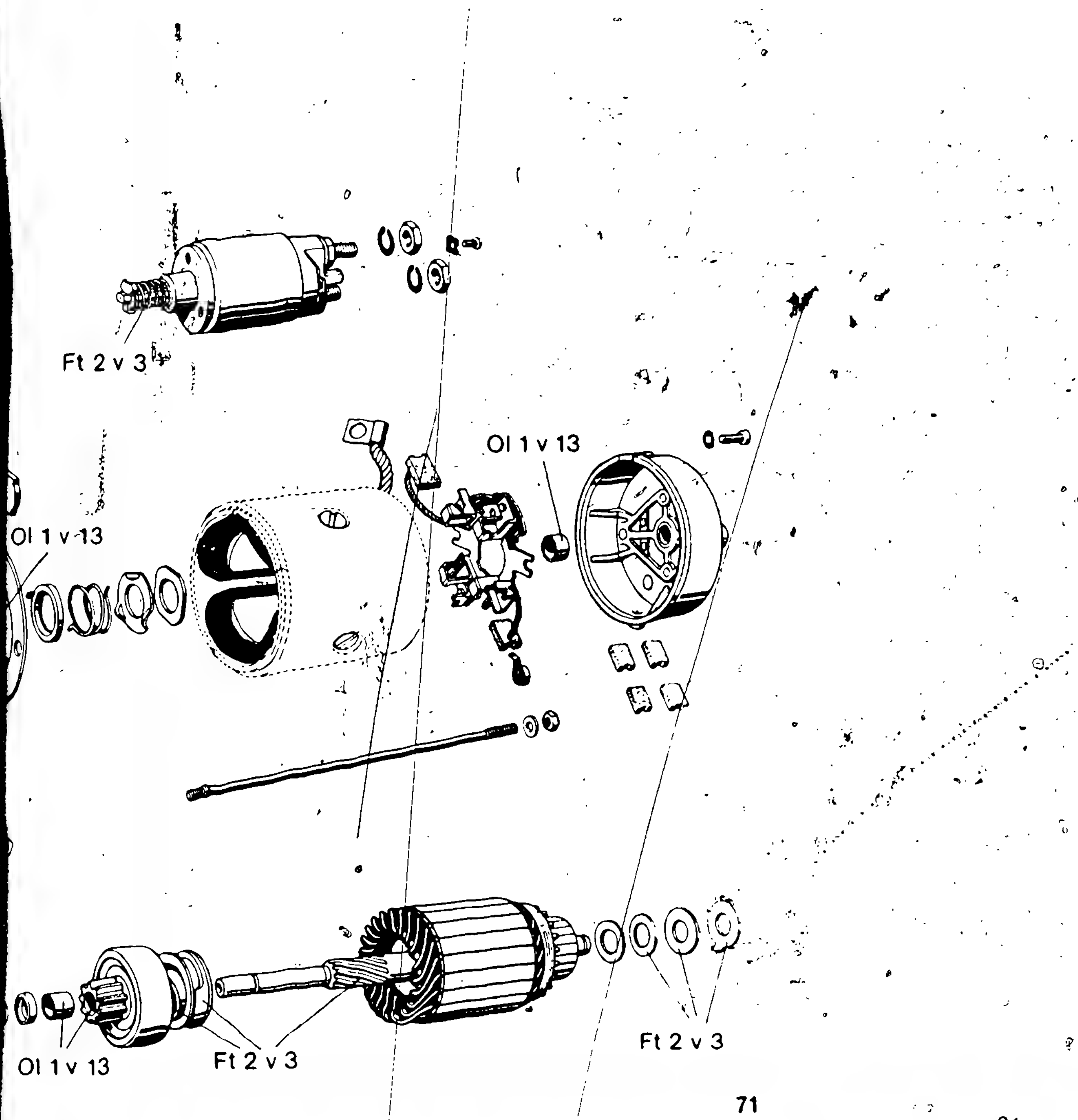
K22

5.9.4 0 001 314 .. GE



4 23

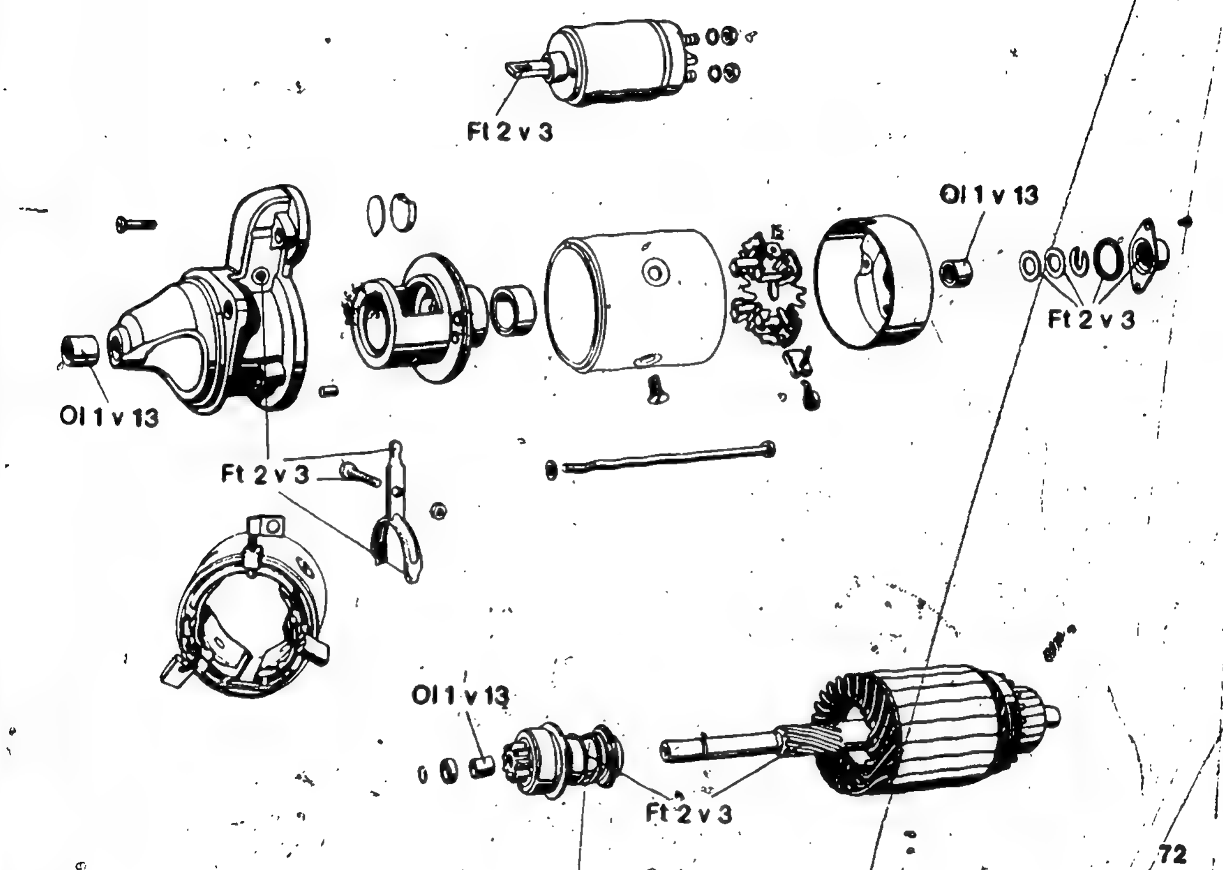
4 24



Lr 24

K24

5.9.5 0 001 315 .. GE



5.10

0 001 354 .. (JD 12 V 1.8 PS)
.. **355** .. (JD 12 V 2.0 PS)
.. **356** .. (JD 12 V 3 PS)
.. **359** .. (JD 12 V 4 PS; 3 kW)
.. **364** .. (JD 24 V 5 PS; 4.8 kW)
.. **365** .. (JD 12 V 5 PS; 3.1 kW)

5.10.1 Mechanical test specifications

		.. 354 ..	.. 354 031	.. 355 ..
Brush pressure	N	1000–1300	1000–1300	1000–1300
Min. carbon brush length	mm	15.5	15.5	15.5
Setting "a" relay	mm	34.0 ± 0.2	35.0–0.2	34.0 ± 0.2
Burn-off reserve	mm	1.0–2.0	1.0–2.0	1.0–2.0
Armature longitudinal clearance	mm	0.1–0.3	0.1–0.3	0.1–0.3
Armature braking torque	Ncm	45–75	45–75	45–75
Overrunning torque overrunning clutch	Ncm	26–32	26–32	26–32
Commutator dimension (new)	mm dia.	42	42	42
Minimum dimension	mm dia.	39.5	39.5	39.5

		.. 355 003	.. 358 ..
Brush pressure	N	1000–1300	1000–1300
Min. carbon brush length	mm	15.5	15.5
Setting "a" relay	mm	35.0 ± 0.2	52.7 ± 0.2
Burn-off reserve	mm	1.0–2.0	1.0–2.0
Armature longitudinal clearance	mm	0.1–0.3	0.1–0.3
Armature braking torque	Ncm	45–60	60–80
Overrunning torque overrunning clutch	Ncm	20–30	26–32
Commutator dimension (new)	mm dia.	42	42
Minimum dimension	mm dia.	39.5	39.5

		.. 358 2 ..	.. 359 ..	.. 360 .. (JD 24 V 4 PS)
Brush pressure	N	2600–2800	2600–2800	2800–3800 as of 11.75 3800–4000
Min. carbon brush length	mm	15.5	15.5	15.5
Setting "a" relay	mm			–
Burn-off reserve	mm	1.2–1.5	1.0–2.0	0.7–1.3
Armature longitudinal clearance	mm	0.1–0.3	0.1–0.3	0.1–0.4
Armature braking torque	Ncm	80–120	45–75	4 .. 5.5 5 .. 12
Overrunning torque overrunning clutch	Ncm	45–55	40–55	4 .. 5.5 4.5 .. 7.5
Commutator dimension (new)	mm dia.	42	42	42
Minimum dimension	mm dia.	39.5	39.5	39.5

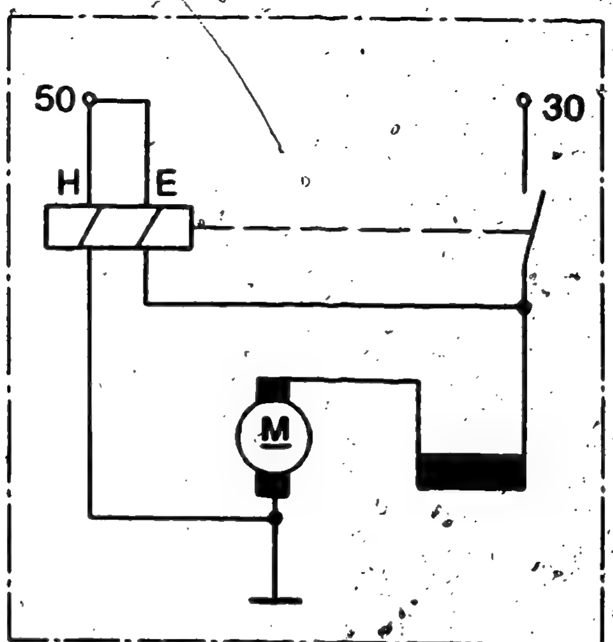
		.. 364 .. (JD 24 V 5 PS)	.. 365 .. (JD 12 V 5 PS)
Brush pressure	N	2800 .. 3800	2800 .. 3800 as of 11.75
Min. carbon brush length	mm	15.5	15.5
Setting "a" relay	mm	–	–
Burn-off reserve	mm	0.7 .. 1.3	0.7 .. 1.3
Armature longitudinal clearance	mm	0.1 .. 0.4	0.1 .. 0.4
Armature braking torque	Ncm	4.5 .. 7.5	5 .. 12
Overrunning torque overrunning clutch	Ncm	4.5 .. 7.5	4.5 .. 7.5
Commutator dimension (new)	mm dia.	42	42
Minimum dimension	mm dia.	39.5	39.5

Tightening torque of pole shoe screws (all J starting motors) = Nm 37 .. 53

4 27

W-001/103
Seite 33

5.10.2 Diagram



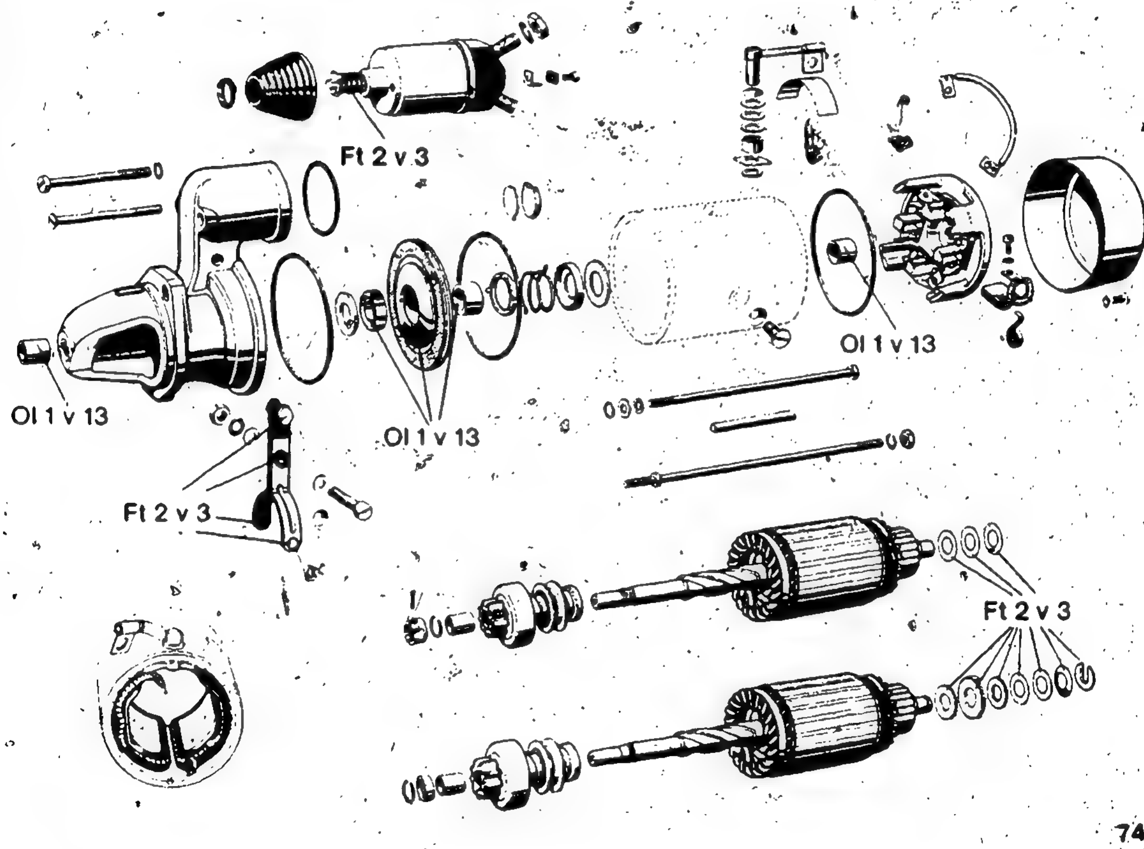
73

K28

K 28

5.10.3

0 001 354 ..	JD 12 V 1.8 PS	.. 360 ..	JD 24 V 4 PS
.. 355 ..	JD 24 V 1.8 PS	.. 3641 ..	JD 24 V 5 PS
.. 358 ..	JD 12 V 3.0 PS	.. 365 ..	JD 12 V 5 PS
.. 359 ..	JD 12 V 4.0 PS		



L1

5.11
0 001 362 .. (JF 12 V 2.5 PS)
.. **363** .. (JF 24 V 2.5 PS)
.. **366** .. (JF 12 V 1.9 PS)

5.11.1 Mechanical test specifications

		.. 362 ..	.. 362 025
Brush pressure[1]	N	11.5 .. 13	11.5 .. 13
as of date of manufacture 621 (1.76)	N	24	24
Min. carbon brush length[1]	mm	15.5	15.5
Burn-off reserve	mm	0.7 .. 1.3	0.7 .. 1.3
Armature longitudinal clearance	mm	0.1 .. 0.3	0.1 .. 0.3
Armature braking torque	Nm	0.45 .. 0.75	0.45 .. 0.75
Overrunning torque overrunning clutch[1]	Nm	0.28 .. 0.4	0.4 .. 0.55
Commutator dimension (new)	mm dia.	42	42
Minimum dimension	mm dia.	39.5	39.5

		.. 362 034	.. 363 ..
Brush pressure[1]	N	12 .. 25	11.5 .. 13
as of date of manufacture 621 (1.76)	N	24	24
Min. carbon brush length[1]	mm	15.5	15.5
Burn-off reserve	mm	0.7 .. 1.3	0.7 .. 1.3
Armature longitudinal clearance	mm	0.1 .. 0.3	0.1 .. 0.3
Armature braking torque	Nm	0.45 .. 0.75	0.45 .. 0.75
Overrunning torque overrunning clutch[1]	Nm	0.4 .. 0.55	0.28 .. 0.40
Commutator dimension (new)	mm dia.	42	42
Minimum dimension	mm dia.	39.5	39.5

Tightening torque of pole shoe screws for all J starting motors
Nm 37 .. 53

[1] in the case of tubular carbon brush holders:
minimum length 8.5 mm, brush pressure cannot be measured.

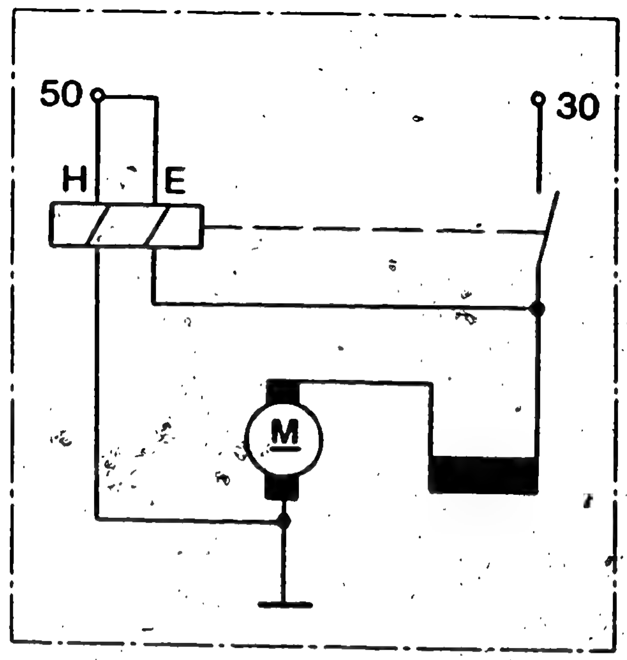
		.. 366 ..	.. 367 ..
Brush pressure[1]	N	12 .. 25	–
as of date of manufacture 621 (1.76)	N	24	–
Min. carbon brush length[1]	mm	15.5	8.5
Burn-off reserve	mm	0.7 .. 1.3	0.7 .. 1.3
Armature longitudinal clearance	mm	0.1 .. 0.3	0.05 .. 0.4
Armature braking torque	Nm	0.45 .. 0.75	0.5 .. 1.2
Overrunning torque overrunning clutch[1]	Nm	1.5 .. 30 at 54 mm OD 3.5 .. 6.5 at 60 mm OD	0.35 .. 0.65
Commutator dimension (new)	mm dia.	42	45
Minimum dimension	mm dia.	39.5	42.5

		.. 368 ..
Brush pressure[1]	N	–
as of date of manufacture 621 (1.76)	N	–
Min. carbon brush length[1]	mm	8.5
Burn-off reserve	mm	0.7 .. 1.3
Armature longitudinal clearance	mm	0.05 .. 0.4
Armature braking torque	Nm	0.5 .. 1.2
Overrunning torque overrunning clutch[1]	Nm	0.35 .. 0.65
Commutator dimension (new)	mm dia.	45
Minimum dimension	mm dia.	42.5

Tightening torque of pole shoe screws for all J starting motors
Nm 37 .. 53

[1] in the case of tubular carbon brush holders:
minimum length 8.5 mm, brush pressure cannot be measured.

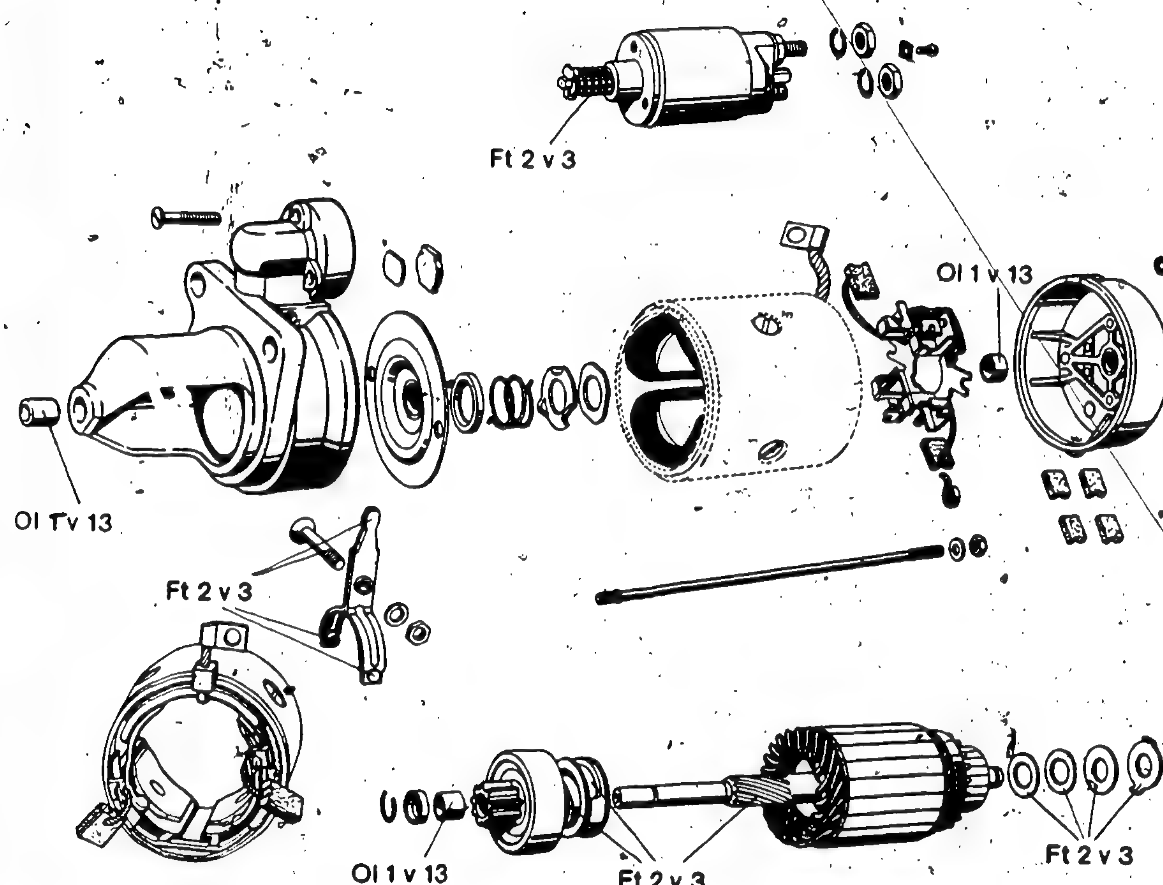
5.11.2 Diagram



L4

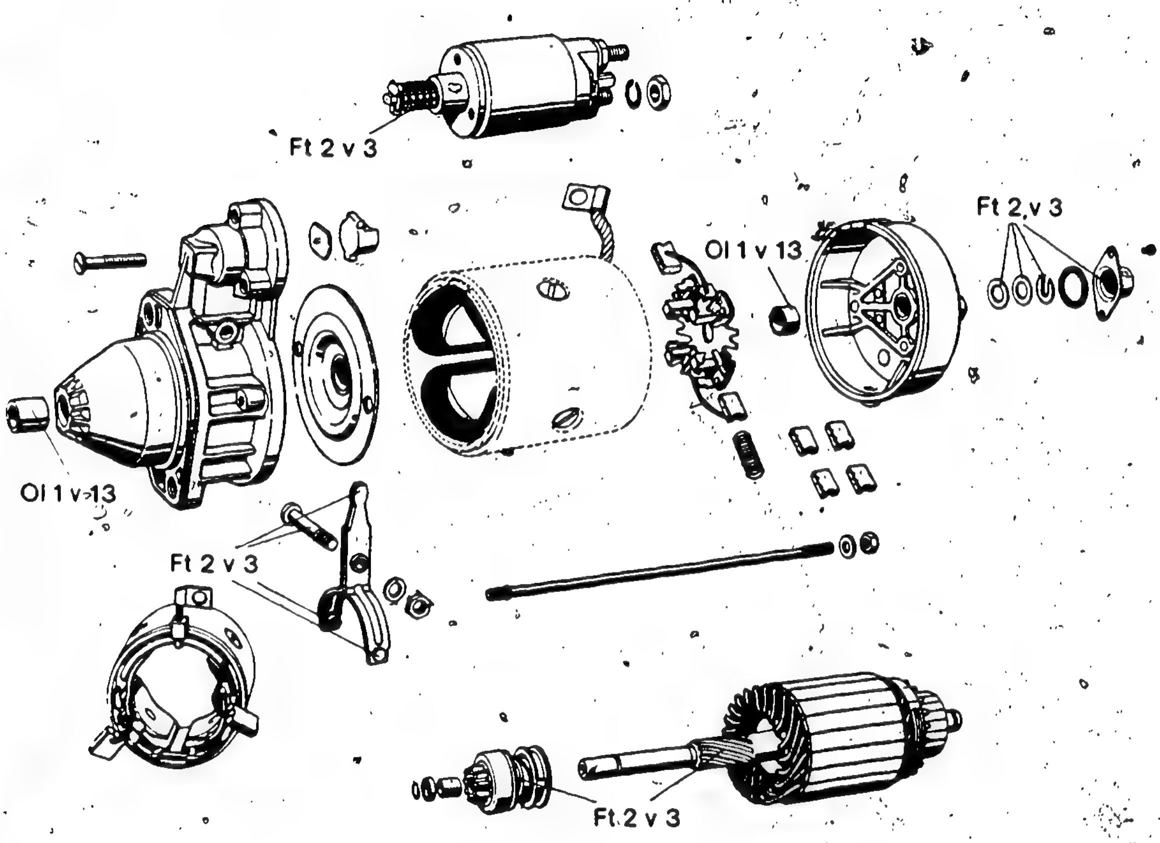
L4

5.11.3 0 001 362 0 ..
0 001 363 101



76

5.11.4 0 001 366 038 JF



77

L 6

6. Further technical documents

KH/VDT EE ..	Service part microfiches
VDT-WJA 021/2	Installation of self-lubricating bushings
VDT-WJA 021/3	Replacement of excitation windings
VDT-W-001/100	Repair instructions for submersible starting motors
VDT-WPE 510/2	Test instructions for starting motors
VDT-WPE 510/207	Test specifications for starting motors
VDT-WPE 510/2-11	Test specifications (diagrams)
VDT-V 1/2	Sales catalogue (containing greases and oils)
VDT-WPE 712/1	Test instructions for relays
VDT-WPE 712/1-1	Test specifications for relays

VDT-BME 512/99 B AL 00

<VDT-I-001/103 B >

Edition 1.1975
Translation of German edition of 20.12.1974

Destroy edition of 11.74

0 001 359 .. - ID (R) 12 V 4 PS
0 001 360 .. - ID (R) 24 V 4 PS
0 001 365 .. - ID (R) 12 V 5 PS
0 001 364 .. - ID (R) 24 V 5 PS

Modification of starting motor drives 2 006 209 4..

To improve the meshing process of ID 4 and ID 5 PS starting motors, the position of the spiral spline in the driver of the 6-roller overrunning clutch drive 2 006 209 4.. will be changed as from October/November 1974 (date of manufacture 430 and 431). (Fig. 1). The Part Number of the starter drive remains unchanged.

For this reason, 5-roller overrunning clutch drives 2 006 209 3.. are not in all cases interchangeable with 6-roller clutch drives 2 006 209 4...

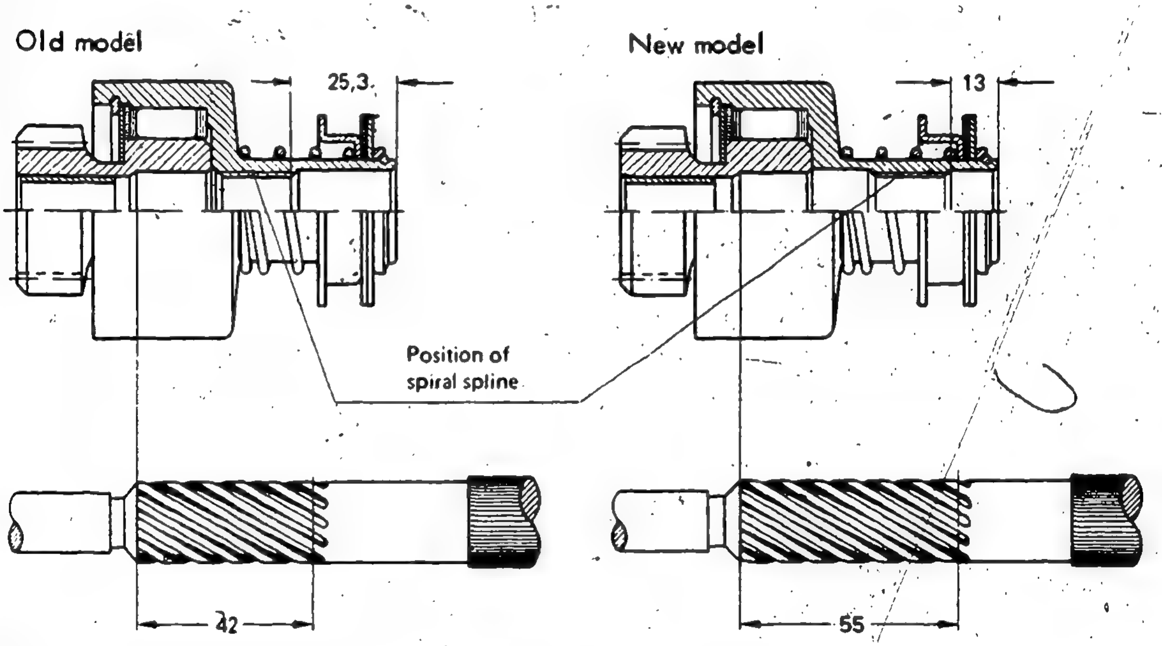


Fig. 1

ID 4 PS starting motors with shunt field have been fitted with long spiral spline (55 mm) armatures since the end of 1972.

Old model	New model
2 004 004 061	2 004 004 112 (12 V)
062	2 004 004 111 (24 V)

Similarly ID 5 PS starting motors have been fitted with long spiral spline (55 mm) armatures since the end of 1973. The part number remains unaltered thereby.

L 8

BOSCH

The ID 4 PS starting motors without shunt field have always been equipped with armatures with a 55 mm long spiral spline (fig. 1). In these cases, the 5-roller overrunning clutch drive 2 006 209 3.., the modified 6-roller clutch drive and, as far as it still exists, the old 6-roller clutch drive can be used.

In future, armatures with short spiral splines (42 mm) only can be mounted together with the 5-roller overrunning clutch drive 2 006 209 3...

To avoid errors, after each repair the distance between pinion (at rest position) and stop ring should be checked (fig. 2). It should be 18 ± 1.5 mm.

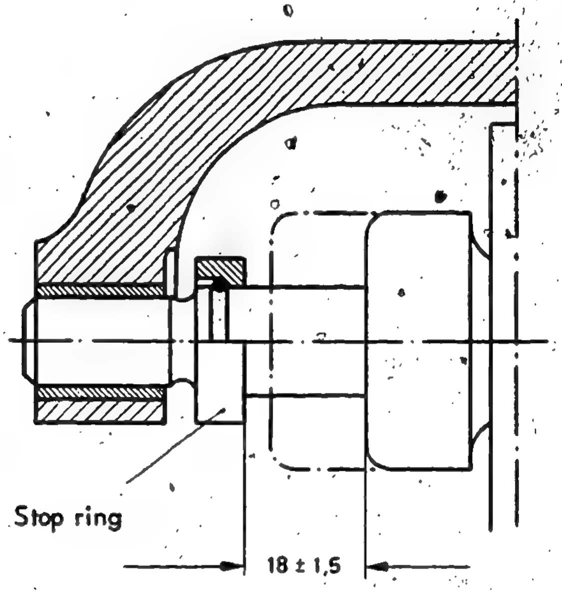


Fig. 2

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K1
Abteilung VAK6

L9

Conversion from the 5-roller-type to the 6-roller-type starting-motor drive with short spiral spline on the armature shaft (42 mm) in starting motors

00
VDT-I-001/103 B
Suppl. 1
5. 1977
Destroy edition 2. 1976!

0 001 359 . . – JD 12 V 3 kW
360 . . – JD 24 V 4 kW
365 . . – JD 12 V 3.7 kW
364 . . – JD 24 V 4.6 and 4.8 kW

From date of manufacture 725 (May 1977) on, only the 6-roller-type drives 2 006 209 341 . . . 349 are available instead of the 5-roller-type drives 2 006 209 301 . . . 309 (the two drives are interchangeable).

The new drives are designed for those types of starting motor whose spiral spline on the armature shaft is 42 mm long.

old 5-roller-type drive	new 6-roller-type drive
2 006 209 301	2 006 209 341
302	342
303	343
304	344
305	345
306	346
307	347
308	348
309	349

If the spiral spline of the armature shaft is 55 mm long, only the drives 2 006 209 4.. can be fitted.

Please observe also the technical bulletin VDT-I-001/103 B when repairing starting motors.

L10

BOSCH
Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

STARTER 0 001 359 .. JD 12 V 3 kW
0 001 360 .. JD 24 V 4 kW
0 001 364 0. JD 24 V 4.6 kW
0 001 364 1. JD 24 V 4.8 kW
0 001 365 .. JD 12 V 3.7 kW

Cross-reference of starting-motor drives

Summary

In our technical bulletins VDT-BME 512/99 and VDT-I-001/103, Suppl. 1 we gave notice of drive changes for JD starters.
This cross-reference has now been brought up to date.

Cross-reference:

former design 1) 5 roller drive	6 roller drive retainer design	new design 6 roller drive with cover sleeve	6 roller drive with cover sleeve (Tech. Bulletin VDT-I-001/103 Suppl. 1) 3)
2 006 209 301	2 006 209 406	2 006 209 436 446 2)	2 006 209 341
302	408	438	342
303	417	447	343
304	410	440	344
305	405	435	345
306	414	444	346
307	412	442	347
308	409	439	348
309	415	445	349

Remarks:

1) Former 5 roller and 6 roller drives with retainer are no longer delivered.

2) For drive 2 006 209 446 the design .. 436 can also be used.

3) 6 roller drives 2 006 209 341 ... 349 must be used for repair work on starters in which the spiral spline on the armature shaft is only 42 mm long.

L 11

BOSCH

Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

L11

0 001 359 .. - JD (R) 12 V 4 PS
0 001 360 .. - JD (R) 24 V 4 PS
0 001 365 .. - JD (R) 12 V 5 PS
0 001 364 .. - JD (R) 24 V 5 PS

Breakdown of starting motors

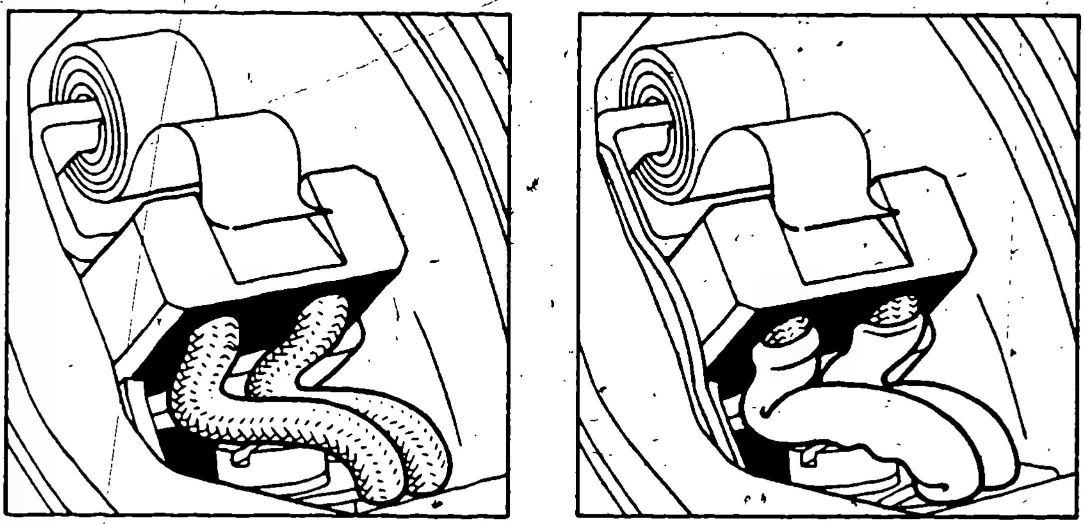
VDT-BME 512/100 B
<VDT-I-001/104>
Edition 1.1975
Translation of German
edition of 3.12.1974

AL
00

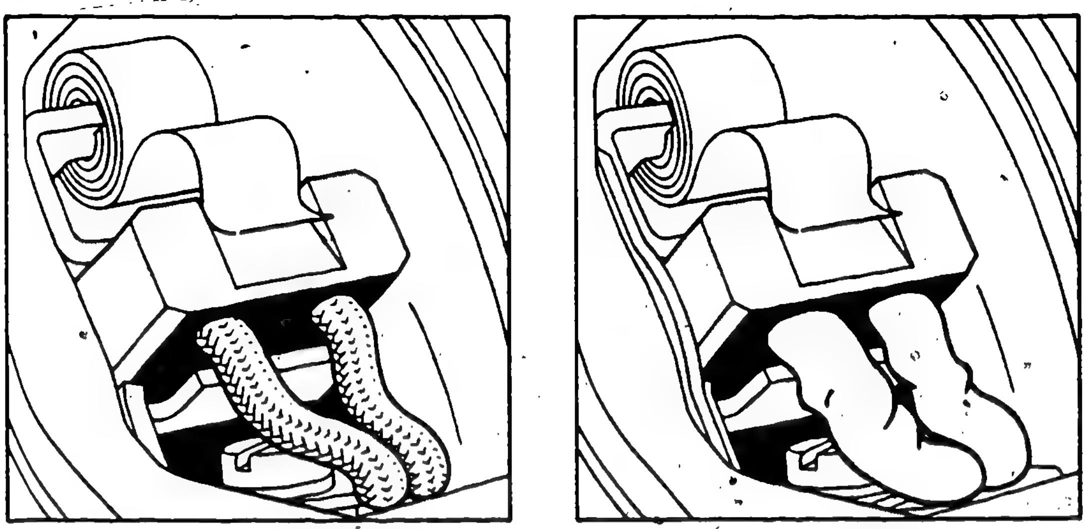
In individual cases there has recently been trouble with the above-listed starting motors, because the carbon brushes have jammed against their incorrectly positioned pigtails(shunts) and could not slide any further in their guides.

This condition causes the commutator to become unsoldered during lengthy operation and the insulation of the joining bar from the excitation winding burns on one side.

As a remedy the position of the pigtails has been changed as follows, as from FD 431 (November 1974):



troublesome positioning of pigtails



operationally safe positioning of pigtails

(introduced as from FD 431)

We would request that you pay careful attention to this when repairing starting motors JD 4...5 PS.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K 1
Abteilung VAK 6

Various Modifications to Starting Motors

00

VDT-I-001/117 B
9. 1976

0 001 358 201, 202 – JD 12 V 2.5 kW (3.3 HP)
0 001 359.. – JD 12 V 3.0 kW (4 HP)
0 001 360.. – JD 24 V 4.0 kW (4 HP)
0 001 364 1.. – JD 24 V 4.8 kW (5 HP)
0 001 365.. – JD 12 V 3.7 kW (5 HP)

In conjunction with our continuing development program, the following modifications have been made in the starting motors listed above.

1. Starting with FD 624, starting motors

   0 001 364 100, ..101, ..102, ..103 and
   0 001 365 004, ..005

   have been fitted with the M10 pole-shoe screw, Part No. 2 910 551 284, instead of the M8 pole-shoe screw, 2 910 559 240, used previously.

2. Modifications in armatures and commutator end shields

   Starting with FD 627, the following changes have been made in the armatures and commutator end shields in the starting motors listed above:

   - the insulating washer or brake disc 2 000 112 006 (microfiche Items 35 and 36), and

     the support disc or brake plate 2 000 147 004 (microfiche Items 35 and 36), as well as

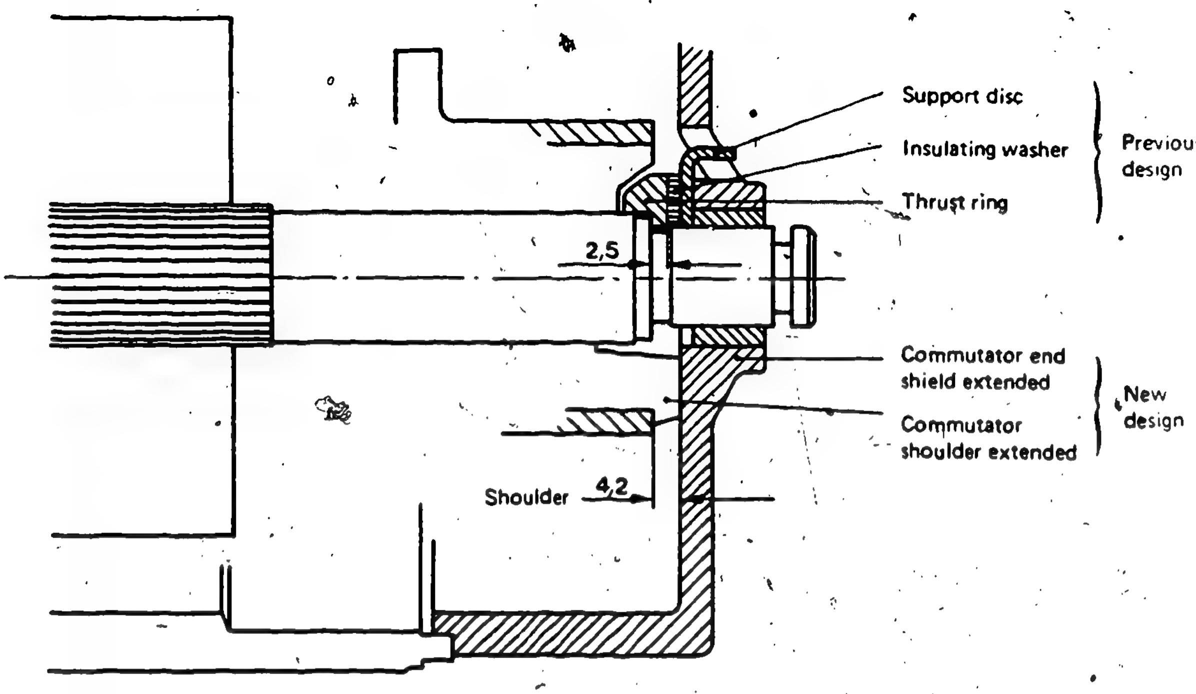
     the thrust ring at the commutator are eliminated.

   - Instead of these parts, the shoulder on the commutator has been extended 4.2 mm and the thrust surface on the commutator end shield has also been extended (towards the commutator) by an amount corresponding to the thickness of the support disc (1,8 mm) (see drawing).

BOSCH

Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

L 14



In the following types of starting motors the armature and the commutator end shield have been modified, but the same Part Nos. have been retained.

For starting motor type 0 001..		Design.	Armature 2 004..	Commutator end shield 2 005 ..
358 2..	JD 12V 2.5kW (3.3 HP)	normal design	004 069	854 053
359 ..	JD 12V 3 kW (4 HP)	normal design	112	053
359 ..	JD 12V 3 kW (4 HP)	heat- and oil-protected	104	085
359 ..	JD 12V 3 kW (4 HP)	oil-protected	103	053
359 ..	JD 12V 3 kW (4 HP)	pinion track on armature axle not hardened	113	053
360 ..	JD 24V 4 kW (4 HP)	normal design	111	052
360 ..	JD 24V 4 kW (4 HP)	oil-protected	114	052
360 ..	JD 24V 4 kW (4 HP)	insulated terminal 31	111	064
365 ..	JD 12V 3.7 kW (5 HP)	normal design	105	088
364 1..	JD 24V 4.8 kW (5 HP)	normal design	115	087

L15

The following points should be noted during repair work:

- If the previous armature is used with a new commutator end shield, the support disc is eliminated.
- If a new armature is used with the previous commutator end shield, the insulating washer is eliminated.
- If a new armature is used with a new commutator end shield, the insulating washer and the support disc are eliminated.

In case of inquiry, please contact your authorized representative.

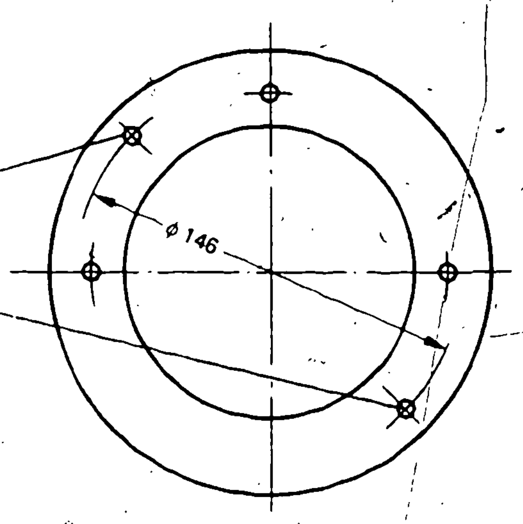
0 001 359 116- JD (R) 12 V 3 kW
Starting motor for BLMC 6-cylinder direct
injection diesel engine 6/98 T/d 5.6 1 104 kW (142 HP)

Clamping possibility on the starting-motor test benches

EFAL 90.., EFAL 140..; EFAW 275

In order to clamp the above-mentioned starting motor on a test bench, 2 additional threaded M 12 holes must be drilled in clamping flange 1 685 720 184 on the line of the imaginary circle diameter 146 ± 1 mm as shown on the diagram.

M 12 threaded holes to
be drilled in addition



Clamping flange, register dia. 102 mm
Part Number 1 685 720 184

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung

Kundendienst KH
Technische Mitteilung

AL
VDT-BME 512/97 B 00
<VDT-I-001/100>
Edition 9.1974
Translation of German edition of 28.8.1974

0 001 362 001 to .. 012 and .. 018-
IF (R) 12 V 2,5 PS and 0 001 363 001-
IF (R) 24 V 2,5 PS -
New excitation winding for starting motors

For the starting motors 0 001 362 001 to .. 012 and .. 018, as well as 0 001 363 001, a parts set with a new excitation winding and with 4 pole shoes is now delivered as replacement.

Starting motor	Parts set	
0 001 362 001 to .. 012, .. 018	2 007 010 039 comprising 1 excitation winding 4 pole shoes	 2 004 114 182 2 002 320 092
0 001 363 001	2 007 010 040 comprising 1 excitation winding 4 pole shoes	 2 004 114 185 2 002 320 092

As from October/November 1974, the new starting motors will be fitted with excitation winding 2 004 114 182 or .. 185 as original equipment.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K 1
Abteilung VAK 6

L 18

MODIFICATION TO THE ARMATURE SHAFT

VDT-I-001/126 En

Starting motor from 0 001 362 034 (JF 12 V 2.0 kW, 2.4 kW)
Starting motor 0 001 363 103 (JF 24 V 3.2 kW)
Starting motor 0 001 366 ... (JF 12 V 1.9 kW)

6.1980

Replaces Ed.1.1980

From the date of production January/February 1979 (FD 921/922) the armature shaft on the following armatures has been strengthened.

2 004 004 074
2 004 004 075
2 004 004 076
2 004 004 077
2 004 004 078
2 004 004 117

Due to the strengthening of the armature shaft the diameter of the commutator increases from 42 to 45 mm.

Armatures with a commutator diameter of 45 mm can also be used with starting motors before FD 921/922. When repair work is carried out, however, the minimum diameter must not be less than 42.5 mm.

When repair work is carried out on starting motors 0 001 362 ...
0 001 363 ...
0 001 366 ...

which were manufactured before FD 921/922, the commutators of the armatures must be checked for any open-circuiting between the commutator laminations and the armature winding. Faulty armatures must be exchanged. The armature must be paid for when the guarantee period has expired.

If, after the appearance of this technical bulletin, starting motors fail due to commutator damage, then Bosch are not liable for any costs when the starting motors are repaired by a Bosch agent.

BOSCH Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

L 19

in starting motors with tubular brush holders 7.1980

0 001 362 034 from JF 12V 2.0 kW, 2.4 kW
. 363 ... JF 24V 3.2 kW
. 366 ... JF 12V 1.9 kW
. 367 ... JF 12V 3.0 kW
. 368 ... JF 24V 4.0 kW

In starting motors

0 001 362 ..
0 001 363 .. } with tubular brush holders
0 001 366 ..

the fastening parts for the carbon brushes (excitation winding, brush holders) have been modified in the series production since the beginning of 1980, so that replacement carbon brushes can be screwed on again (see also Technical Bulletin VDT-I-001/116, section 4). At the same time all carbon brushes have been fitted with reinforced connecting pigtails (shunts).

The following new carbon brush sets with pigtails, screws and nuts for screwing on have been stipulated for repair work:

2 007 014 062 for starting motor 0 001 367 ..
.. 063 for starting motor 0 001 368 ..
.. 068 for starting motor 0 001 362 .., .. 366 ..
.. 069 for starting motor 0 001 363 ..

For starting motors delivered before the start of 1980 carbon brushes without pigtails are still available

2 007 014 057 for starting motor 0 001 362 .., 366..
.. 058 for starting motor 0 001 363 ..

Two further starting motor types which were already fitted with screw-on carbon brushes and which also retain these, are now being fitted with tubular brush holders. The part numbers of the starting motors are thereby changed from:

0 001 359 .. to 0 001 367 .. and
0 001 360 .. to 0 001 368 ..

L 20

BOSCH
Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

Note on repairs:

In the series production the connecting pigtails of the carbon brushes are welded onto the joining bar of the excitation winding or on the brush holder. (Figs. 1 and 2).
When changing carbon brushes the connecting pigtails of the carbon brushes are cut off at the point where they are welded and the replacement carbon brushes are screwed on as shown in Figs. 3 and 4. Care should be taken to see that the electric terminals are in the right position, so that they cannot be twisted (see arrow).

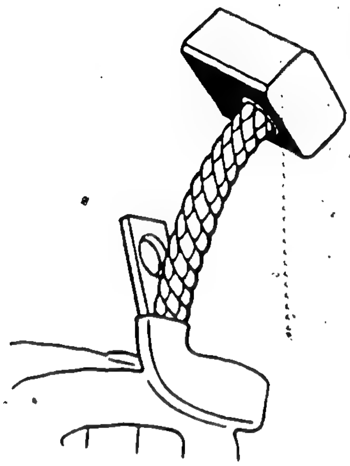


Fig. 1 - Excitation winding welded pigtail

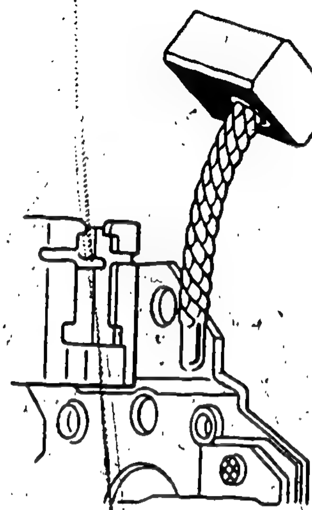


Fig. 2 - Brush holder welded pigtail

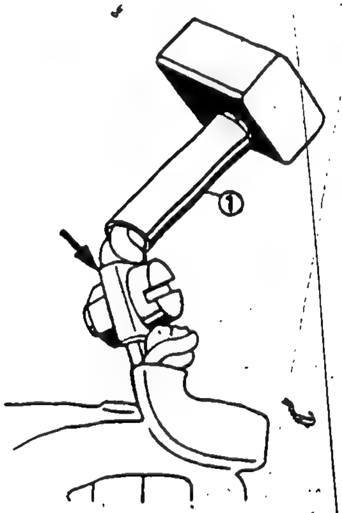


Fig. 3 - Excitation winding screwed pigtail
1 positive carbon brush, red insulation tube

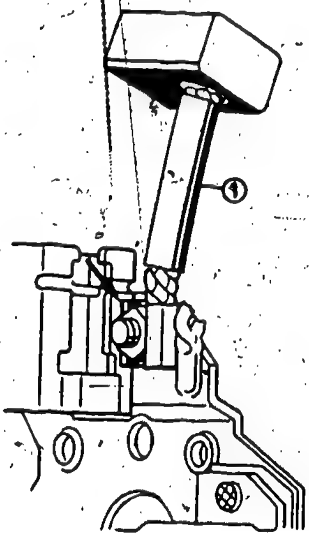


Fig. 4 - Brush holder screwed pigtail
1 negative carbon brush, blue insulation tube

L 21

STARTING MOTORS 0 001 35..
0 001 36..

New solenoid switch
Installation measures

For the changeover to solenoid switch 0 331 402.. as a replacement for the earlier version 0 331 401 .. a spacer ring is provided for axial compensation.

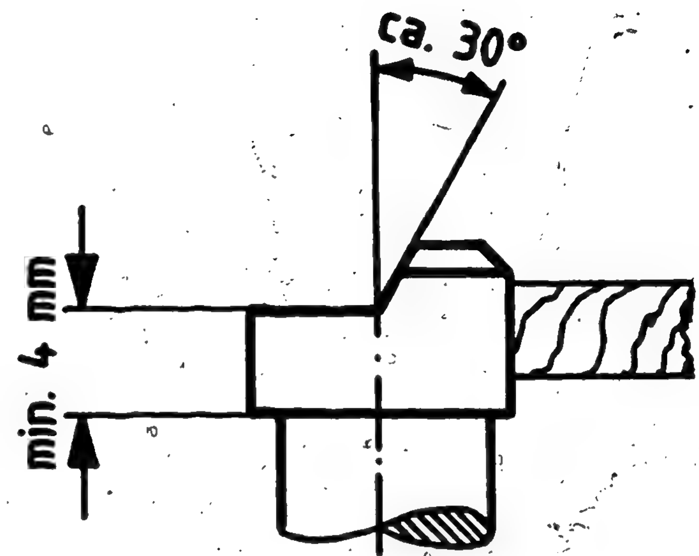
If the old solenoid switch was mounted by 2 screws on the neck of the drive-end-bearing housing, there are 2 threaded holes in the spacer ring for these screws. The spacer ring, in turn, is already fastened to the replacement solenoid switch by 3 fillister-head screws.

If the solenoid switch is fastened to the drive-end-bearing housing with 3 screws, the spacer ring is not screwed onto the replacement solenoid switch, but the likewise enclosed 3 longer fastening screws are passed through the 3 holes in the spacer ring. In this case, the intermediate ring is clamped inbetween when mounting the solenoid switch.

In some older versions of starting motor, it is possible, when mounting the new solenoid switch, for the flanging on its housing to be in contact with the terminal lead-through stud of the field winding (short circuit).

L 22

L22



In this case, it is necessary to rework the stud (see picture). The air gap between solenoid switch and terminal stud should be at least 1.5 mm.

The machined point on the stud should be covered with paint or varnish.

Published by:

ROBERT BOSCH GMBH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

L23

After-sales Service

Technical Bulletin

00

VDT-1-001/116 B

7.1976

0 001 362.. - JF (R) 12 V 2.0 and 2.4 kW (2.5 HP)
0 001 363.. - JF (R) 24 V 3.0 kW (2.5 HP)
0 001 363 1.. - JF (R) 24 V 3.2 kW (2.8 HP)
Release and repair of JF starting motors

Archiv

SUMMARY

1. Introduction and features of the new JF starting motors.
2. Cross-reference of old/new JF starting motors and drive end shields.
3. Repair of old JF starting motors with gray cast iron drive end shield.
4. Changing carbon brushes in new JF starting motors.

1. Introduction and features of the new JF starting motors

New further-developed JF starting motors have been manufactured since FD 621 (Jan 76). It is intended that the transition be completed by the end of 1976.

Features of the new JF starting motors.

- 6-roller overrunning clutch with locating ring.
- Overrunning clutch stop at the spiral spline runout with shortened spiral spline.
- Mechanical armature brake with helical spring (between laminated armature core and intermediate bearing) has been omitted; instead the brush pressure has been increased to 24 N (2448 p) and a closed-type brush holder with helical spring has been introduced.
- The commutator touches the brush plate with its projecting collar, this means that the shims can be omitted.
- The pilot for the solenoid switch is omitted.
- The armature end play is no longer set internally, but at the commutator end shield.
- The sealing rubber on the exciter field connection is sprayed onto the lead and the gray-cast-iron drive end shield is sealed on the curved solenoid switch surround. With aluminum pressure die cast end shields the curved surround remains open, but here the sealing rubber has been improved.

L 24

BOSCH
Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

L24

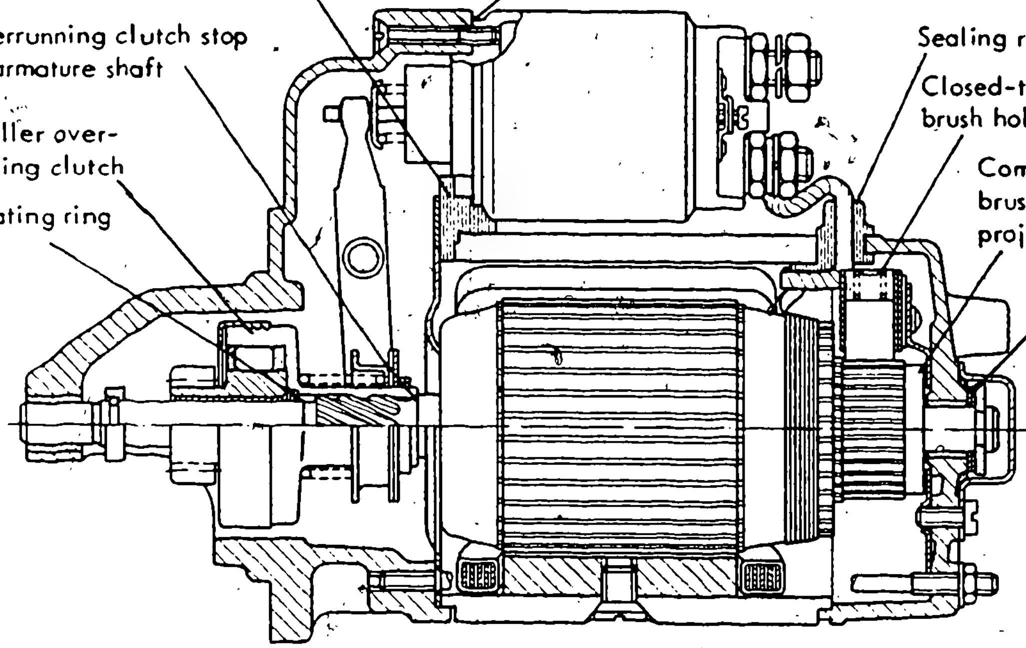


Fig. 1 New type of starting motor with open drive end shield

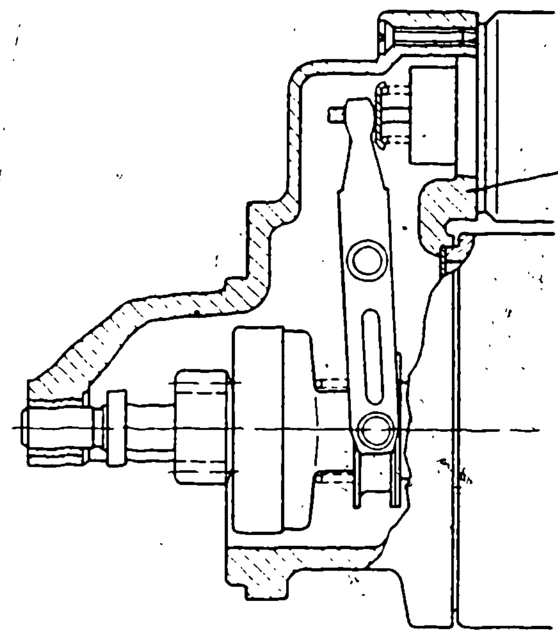


Fig. 2 New type of starting motor with closed gray cast iron drive end shield

2. Cross-reference

The starting motors listed here are being replaced by the new models; most of the drive end shields have been given new part numbers.

The new drive end shields can be used for the old types of starting motor provided that point 3 is observed.

Starting motor models old	new	Drive end shield old	new	Material
0 001 362 006	0 001 362 045	2 005 824 468	2 005 824 820	Gray cast iron
007	053* +2 006 209 472	457	457○	Gray cast iron
008	0 001 362 049	477	477	Gray cast iron
011	054 +2 006 209 475	501	501○	Gray cast iron
013	041	543	829	Gray cast iron
015	037	555	840	Die casting
016	034	549	794	Die casting
017	040	552	808	Gray cast iron
018	054	501	501○	Gray cast iron
019	048	591	591	Gray cast iron
020	042* +2 006 209 474	630	834	Gray cast iron
021	050	615	615	Gray cast iron
022	035	636	799	Gray cast iron
023	036	636	799	Gray cast iron
024	041	652	829	Gray cast iron
025	043	655	655	Gray cast iron
026	055	660	660	Gray cast iron
028	038	674	802	Die casting
030	047	680	680	Die casting
031	056	723	723	Gray cast iron
032	039	720	811	Gray cast iron
033	053	457	457	Gray cast iron
0 001 363 001	0 001 363 106	525	still open	
101	no replacement as yet	720	-	-
102	363 105	636	799	Gray cast iron
362 044	362 045	820	820	Gray cast iron

Note: * In addition, fit the gears included in delivery in the starting motor.
○ New drive end shields are intended for solenoid switches 0 331 402.. without intermediate disc (see Technical Bulletin BME 512/95 B (8.73).

3. Repair of old-type starting motors

0 001 362 006 and ..008
0 001 362 013 up to...033
0 001 363 001
0 001 363 101, ..102

In the new-type starting motors the drive end shield (made of gray cast iron) is no longer located respective to the stator frame by means of the sealing rubber and the support plate, but by means of a locating lug.

If when repairing old-type starting motors a new drive end shield (gray cast iron, closed design) is required, observe the following:

On account of the drive end shield conversion, the 17.5 mm locating groove, in the stator frame, for the rubber seal (Fig. 3) has been replaced by a 3.5 mm wide locating lug (Fig. 4). At the same time the drive end shield has been provided with a 3.5 mm wide locating groove.

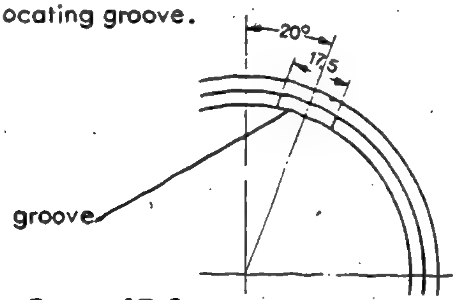


Fig. 3 Groove 17.5 mm (old type)

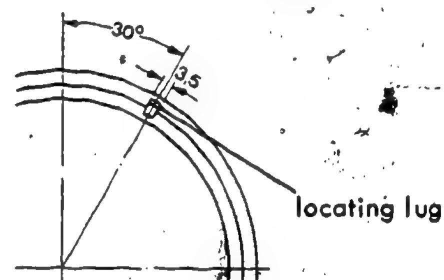


Fig. 4 Locating lug 3.5 mm (new type)

If a new drive end shield with locating groove (3.5 mm wide) has been supplied for an old-type starting motor with stator frame locating groove (17.5 mm wide), then the drive end shield cannot be located respective to the stator frame. In such a case the drive end shield must be correctly aligned with the stator frame by using the stay bolts between the exciter windings. The stay bolts must not come into contact with the exciter windings.
If a new drive end shield (with locating groove) is paired with an old-type stator frame (17.5 mm wide groove), then the open slot (Fig. 5) must be sealed off during starting motor assembly with sealing putty Hylomar VS 9844 Kk-5 927 350 002 or with Kk 68 V1 - 5 703 210 150.

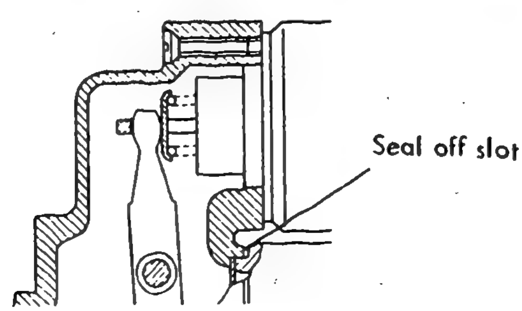


Fig. 5 Drive end shield (gray cast iron) closed

When repairing starting motors with aluminum-cast drive end shield no particular points have to be observed.

4. Changing the carbon brushes in the new JF starting motors

A closed-type brush holder has been introduced in the new starting motors.

Although the carbon brushes have been shortened by 7 mm, their useful life remains the same as before thanks to better guide slots and higher brush pressure.

As mentioned above, instead of the compression spring previously used for the brush spring, a helical compression spring has now taken its place. The brush holders are closed at the rear with 4 holding tabs, on which the brush spring (see Fig. 6) is supported.

If the brushes have to be changed, or the starting motor has to be repaired, the holding tabs on the brush holder must be bent out, so that the brush spring can be removed.

When assembling the starting motor the holding tabs for the brush spring must be bent back into the 30° position in accordance with Fig. 6. In order that the brush holder is not pushed out of shape when the holding tabs are being bent, assembly tool KDAL 5030 should be used (Fig. 7). Assembly tool KDAL 5030 will be available shortly.

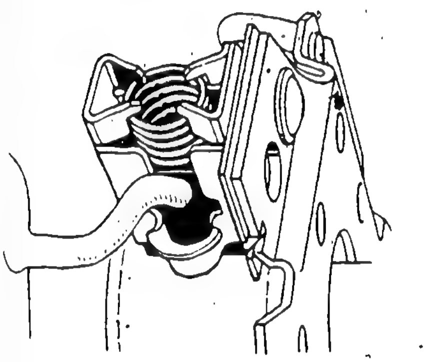


Fig. 6 Holding tabs in closed position

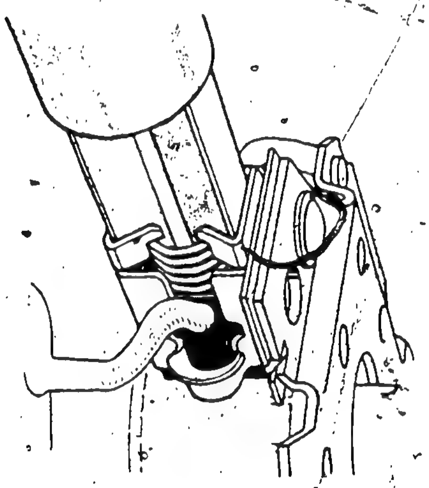


Fig. 7 Bending the holding tabs with the aid of the special tool

For the new type of starting motor the carbon brush sets

2 007 014 057 for 12 V and
2 007 014 058 for 24 V

without pigtails (shunts) have been specified. If it should be necessary to change the brushes, this should be carried out as detailed in Technical Bulletin VDT-BME 512/94 B (12.72). It is important that no soldering tin remain on the carbon brush, otherwise the brush will stick.

STARTING MOTORS IF 12 V - 0 001 362 001 to ..004 and ..362 027 to ..030

00

VDT-I-001/124 En

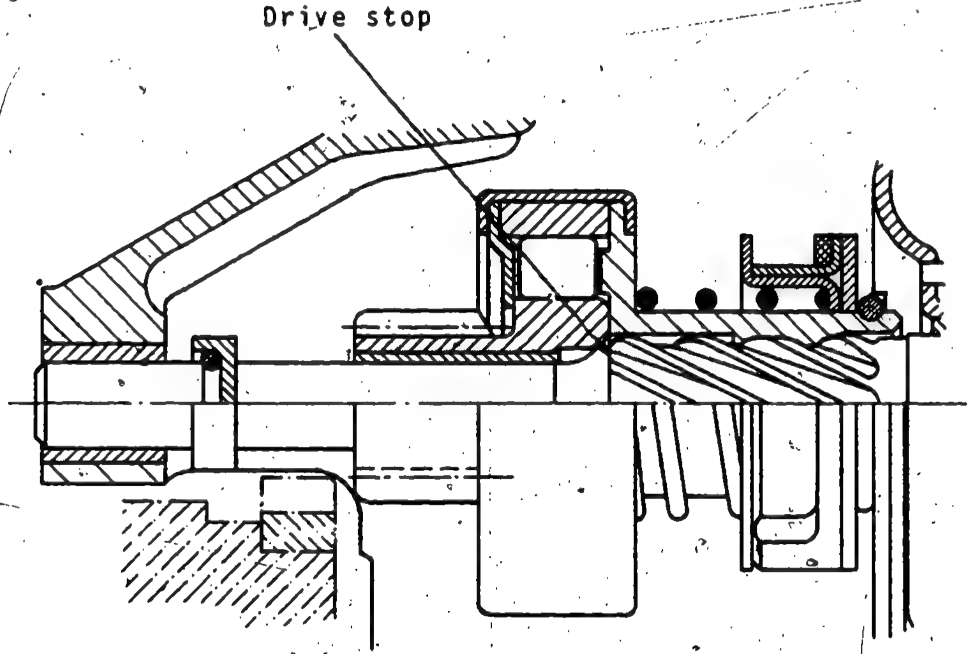
3.1979

Replacement of the starting-motor drive

2 006 209 by 2 006 209 331

On repaired starting motors fitted with the new starting-motor drive 2 006 209 331 it can occur in individual cases that the drive jams on the armature shaft when in the retracted position. This is caused by the pinion damaging the 45° drive stop on the armature shaft at the beginning of the helical spline.

For this reason it is necessary when repairing this type of starting motor, that the drive stop on the armature shaft (see Figure) is checked and repaired if necessary. An oilstone is to be used. The drive stop is NOT to be turned down otherwise the case hardening is damaged.



M1

LOCATION OF THE DRIVE END SHIELD on the STATOR FRAME

VDT-I-001/129 En
10.1980

Starting motor 0 001 367 ... (JF 12V 3kW)
0 001 368 ... (JF 24V 4kW)

As from May 1980 (FD 045), the locating lug in the stator frame and the locating hole in the drive end shield at the 106mm diameter pilot have been omitted on the above-mentioned starting motors.

When repairing these starting motors, the following points must be observed:

If a new drive end shield without locating hole is to be fitted to an old-type starting motor, the locating nose is to be removed from the stator frame. When assembling, the studs are not to contact the excitation windings.

M-2

BOSCH Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

M2

00

0 001 401 060 - KG (R) 12 V 4 HP
0 001 402 079 - KG (R) 24 V 4 HP

VDT-I-001/109 B
Ed. 1 9.75
Translation of German edition of 27.8.1975

Alteration to pinion in starting motors for Volvo-Penta engines

As from November 1975 (FD 531), pinion 2 006 380 410 is being replaced by the special pinion

2 006 380 419.

The new pinion is case-hardened and its spindle hard chrome-plated.

The starting motor designation will not be changed, although for a transition period the starting motors will be denoted with an "H" behind the "FD", and to avoid confusion the pinion teeth will have a groove on the tip diameter.

This alteration has been made necessary by severe pinion wear on the end face side as a result of too hard a ring gear, as well as by some cases of drive spindle corrosion.

If the starting motors mentioned are handed in for repair, they should be fitted with the new pinion 2 006 380 419, against payment. These can be supplied through the usual channels as from November 1975.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K 1
Abteilung VAK 6

M 3

BOSCH

Geschäftsbereich KH Kundendienst

Special Warranty for old multiplate clutch 2 006 401 904 in KG starting motors

00
VDT-I-001/121 B
11. 1977

Due to continued high demand, since August 1977 the old clutch 2 006 401 904 is again available, in addition to the new, considerably improved multiplate clutch 2 006 401 908 or ..518.

Installation of the new clutch is also possible in older KG starting motors after modification of the armature and should preferably be carried out.

Conversion is described in detail in Technical Bulletin VDT-BME 511/42 B, Supplements 1, 2 and 3.

For the following vehicles and starting motors installation of the new clutch is still mandatory:

1. Mercedes-Benz vehicles LP 608 and 808 with engine OM 314.
2. All buses and city vehicles subject to frequent starting.
3. Starting motors 0 001 401 066 and ..402 081.

In the case of other vehicles and starting motors, the workshop, at its own discretion and at the express wish of the customer, can install the old clutch, for which however the ~~normal~~ warranty no longer applies.

Warranty

For the clutch 2 006 401 904 no warranty can be given for duration of use. The warranty applies only to manufacturing and material defects which come to light at the time of installation (warranty type no. 8, storage goods). Clutches with date of manufacture 727 onwards which give cause for complaint should be sent, together with the usual warranty papers, to the authorized representative abroad. You will be recharged for clutches for which we made warranty payment but which were not sent in to us.

Before installing clutch 2 006 401 904 please inform the customer expressly about this warranty and note this on the repair bill. If the customer is not informed and there is no indication on the bill, you yourself are liable to the customer for warranty.

BOSCH
Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

M 4

M4

After-sales Service Instructions

Repairs

00

VDT-W-001/102 B
Ed. 1
supersedes VDT-WJE 511/2 B

Starting motors

0 001 40 . . – KG
0 001 50 . . – QD

BOSCH After-sales Service
Automotive
Equipment

M5

M5

u15

Contents

Automotive Equipment — After-sales Service
Department for Technical Publications KH/VDT
Postfach 50, D-7000 Stuttgart 1

Please direct questions and comments concerning the contents to our authorized representative in your country.

Printed in the Federal Republic of Germany.

Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.
(11.77)

1. Test equipment and tools

Test equipment

Test panel	EFAW 81..	0 681 169..
Transformer panel	EFAW 82..	0 681 169..
Interturn short-circuit tester	EFAW 90..	0 681 169..
or	EFAW 95..	0 681 169..
Coil testing yoke	EFAW 97..	0 681 169 022
Torquemeter 0.15 ... 0.8 Nm	KDAL 5485 (EFAL 26	0 681 400 001)
Torquemeter 1.0 ... 2.5 Nm	commercially available (EFAL 54	0 681 400 003)
Torquemeter 33 ... 300 Nm	KDAL 5476 (EF 2368 B	0 681 400 007)
or		
Torque wrench	commercially available	
Spring scale 0 ... 20 N	KDAW 9992 (EF 1244 A	0 681 400 005)
Spring scale 0 ... 50 N	KDAW 9993 (EF 1244 B	0 681 400 006)
Spring scale 0 ... 160 N	commercially available (EF 5206	1 681 130 009)
Feeler gauge	commercially available	
Ohmmeter	commercially available	

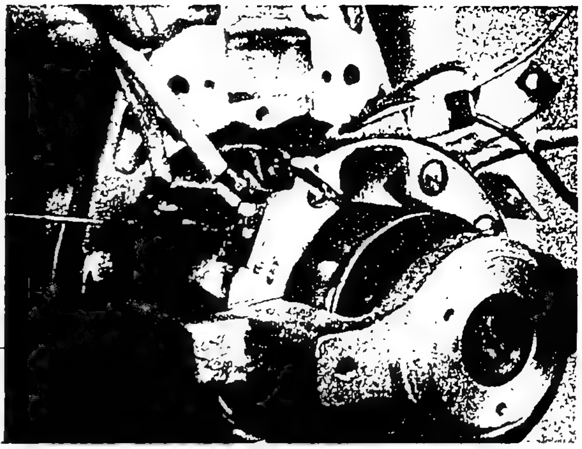
Tools

Clamping support	KDAW 9999 (EFAW 9	0 681 269 007)
Undercutting saw	KDAW 9998 (EFAW 10	0 681 269 008)
Pin wrench Pin 5 mm	KDAL 5002	
Pin wrench Pin 4 mm	KDAL 5498 (EFAL 91	1 687 950 011)
Pin wrench Pin 3 mm	KDAL 5499 (EF 3141 A	1 687 950 044)
Pin wrench QD	KDAL 5497 (EF 2212 A	1 687 950 047)
Forcing-off and forcing-on device for drive flange	KDAL 5473 (EF 2583 A	0 681 200 005)
Puller for armature and pinion	KDAL 5490 (EFAL 16	0 681 300 002)
Puller for pinion	KDAL 5492 (EFAL 39	0 688 110 010)
Finishing tool for pinion bushings	KDAL 5495 (EF 2635	1 683 124 001)
Forcing-on device for drive flange	KDAL 5026	
Scraper	KDAL 5478 (EF 2621	1 687 953 000)
Special screwdriver (slotted) for QD guide pins	commercially available	

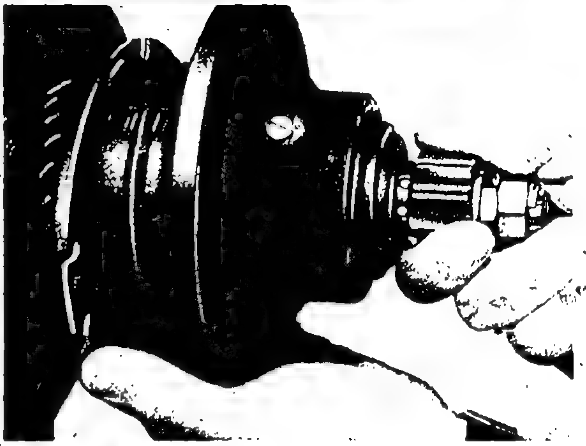
W-001/402

2. Dismantling

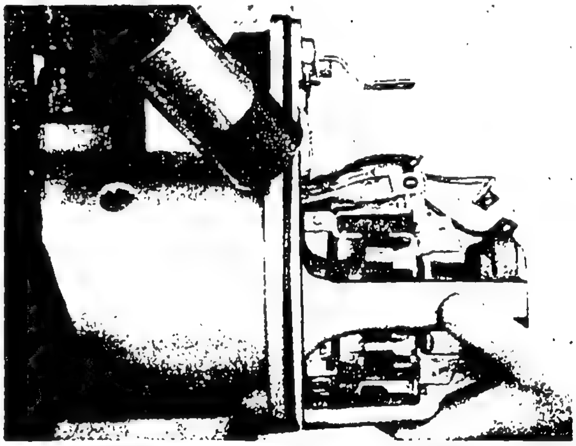
Unscrew closing cover.
Detach control relay wires and connections from current bridge and carbon brushes.
Unscrew relay from commutator end shield.
Remove carbon brushes.
Unscrew locking nut of guide pin in starting motor armature.


1

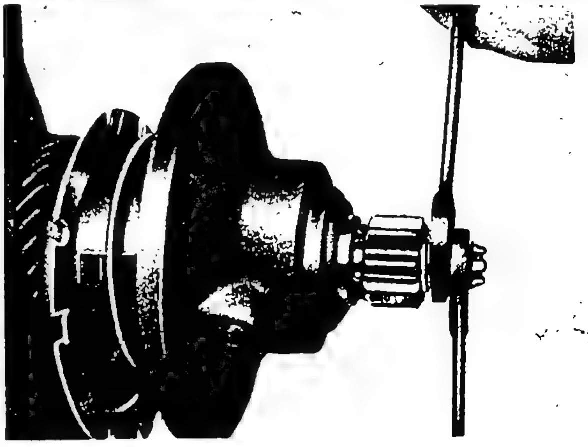
Loosen drive end shield and push back from stator frame (do not pull off over pinion). Remove armature from stator frame.


2

Remove commutator end shield. Pay attention to two joining bars in starting motors with insulated negative brushes. All other starting motors have only one joining bar.


3

Remove pinion with drive end shield, free tombak disc, complete multiplate clutch, pinion spring and supporting ring from armature.
When removing the drive end shield do not take it off over the pinion but in the opposite direction over the splines.
Remove tripping disc and unscrew guide pin from armature (commutator side).


4

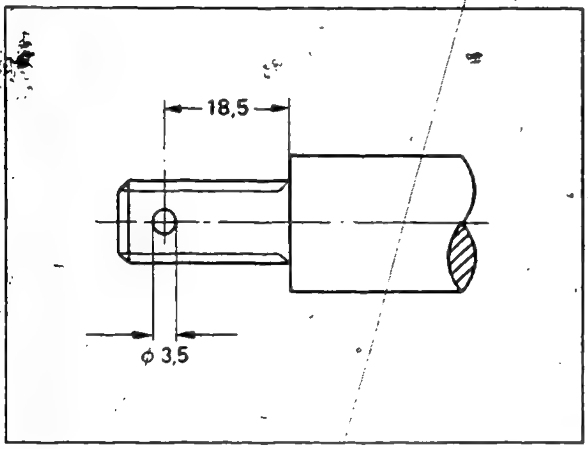
3. Cleaning of parts

Wash individual parts in benzine or trichlorethylene and blow off with compressed air.
Do not place armature, windings and relay in washing agent.

4. Examination and repairs

Examine all parts for wear and mechanical damage.
Slightly lubricate bright parts with rust-inhibiting oil Ol 41 v 2.
See section 8 for lubrication chart.
See VDT-W-001/100 B for specific information regarding submersible starting motors.

4.1 Armature

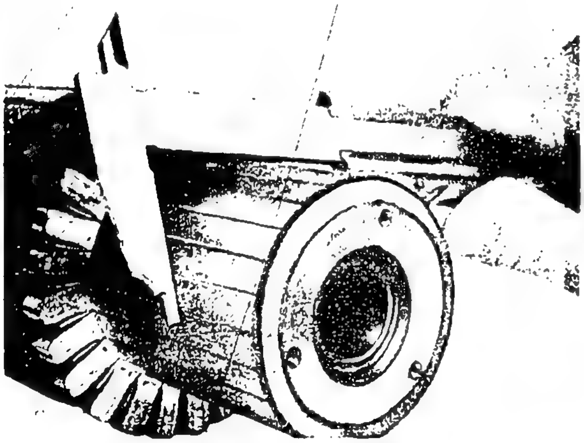


5

Test armature for short-circuit to chassis and interturn short-circuit.

Test voltage for chassis short-circuit test:
6 and 12 V armature 40 V AC
24 V armature 80 V AC

Use only armatures with slotted nuts (castle nuts) as per service parts microfiche.
If necessary, drill split-pin hole as shown in drawing opposite.

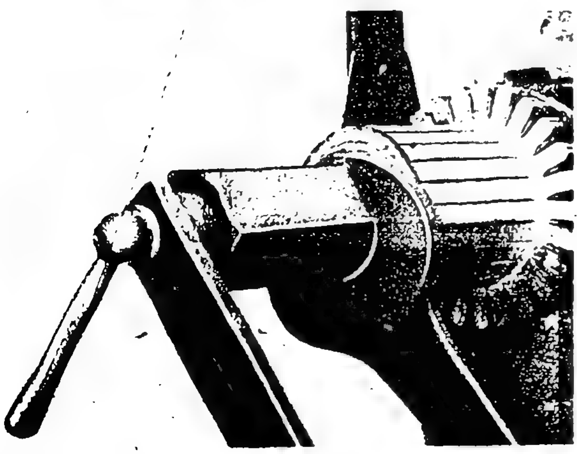

6

If necessary, re-turn commutator and saw out insulation. Armature must then be re-tested for short-circuit to chassis and interturn short-circuit.
Make sure that soldered joints on commutator risers are good.

Caution! If commutator is burned on one side, there is danger of open-circuit in the armature winding.

Minimum commutator diameter:
KG starting motor 45 mm
QD starting motor 59 mm

True running deviations:
Commutator max. 0.03 mm
Laminated core max. 0.05 mm


7

Remove bushing from armature using puller.

Inner diameter of bushing:
KG starting motor 16.6 mm
QD starting motor 21.0 mm

Place self-lubricating bushing in oil Ol 1 v 13 half an hour before installation.

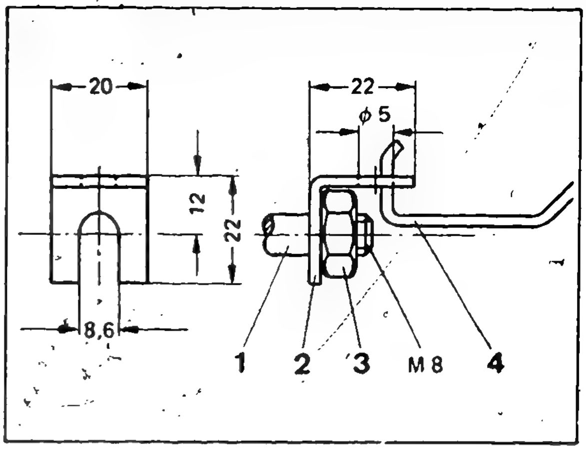
Insert new bushing using suitable press-in mandrel.
Bushing must be flush with steel guide bush.

Insert guide pin with armature-return spring and tighten.
Measure pre-load of armature-return spring:
Pay attention to mark on guide pin.
Use spring scale. Manufacture bracket as per drawing.

1 = Guide pin in starter armature
2 = Bracket
3 = Nut
4 = Tie rod of spring scale

For 12 V starting motors 38 ... 42 N without mark on guide pin.
Guide pins with spot mark and 46 N helical spring should always be replaced with pins with 38 ... 42 N springs.
For 24 V starting motors guide pins with 38 ... 42 N (without mark) or 46 N (with point mark) springs can be fitted. Old guide pins with 35 N helical springs can continue to be used in 12 V and 24 V starting motors.

Insert new gasket (oil-impregnated) on commutator side and secure tripping disc (plate washer) with new flat-head screws.



8

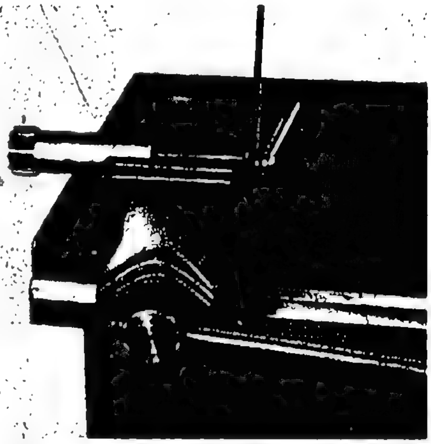
4.2 Pinion

Visual examination
The pinion is to be replaced if its teeth are damaged (worn) or in the event of excessive bearing clearance on the armature shaft. If only the bushings have worn, these can be removed one after the other using the puller.
Place bushing in oil Ol 1 v 13 half an hour before pressing in.
Do not forget spacer sleeve.

4.3 Drive end shield

Replacing worn bushings: remove lubricating strips, lubricating wick and helical spring; use a suitable mandrel and puller for pressing the bushings in and out.

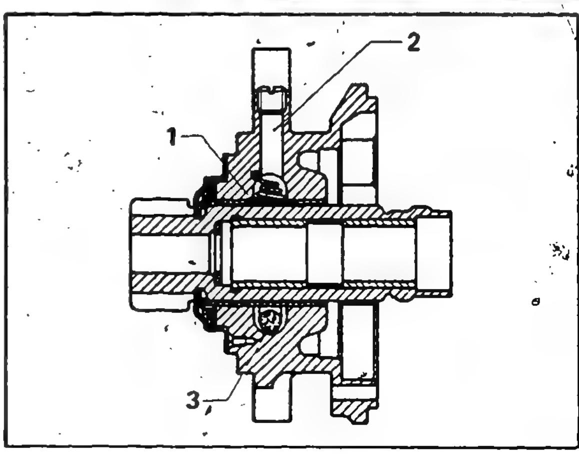
Test bearing with new pinion for freedom of movement. Insert helical spring with pin into oil duct bore. Insert lubricating felt and wick.


9

Various bushing designs:

A. Babbitted bushing for non vibration-proof starting motors.

B. Steel bushing for vibration-proof starting motors. This bushing can be fitted instead of babbitted bushing. Press in bushings with collar (in these designs) as far as the stop. Turn projecting collar or protruding bushing end face until flush with cast surface of drive end shield (do not turn cast surface).



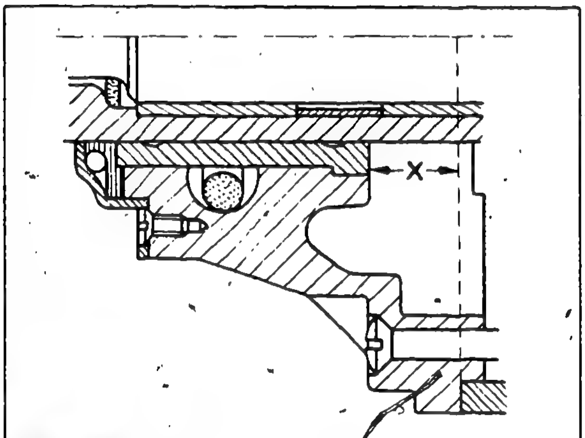
10

1 = Impregnate lubricating felt with VS 12037
2 = Fill bore with VS 12037
3 = Impregnate lubricating wick with VS 12037

M9

The drive end shields are serrated to prevent them from turning. With the older type of drive end shield (without serration), the babbitted type of bushing must be secured against turning by means of a locating pin. Drill 7 mm deep, 4.9 mm dia. hole for locating pin between bushing and drive end shield.

C. Wrapped composite bushing
This bushing is at present being fitted during-production. It is suitable for vibration-proof starting motors. The outer diameter of this bushing is smaller, so it cannot be fitted as a replacement for babbitted or steel bushings. In this case the complete drive end shield must be replaced.
Press in wrapped composite bushings until bushing is flush with coupling running surface of drive end shield. Securing with locating pin is not required.



11

General work to be performed on all bushings: after pressing in, turn out bushing, first sealing lubrication hole with cardboard strip. Ream bushing with drawn reamer (commercially available).

Dimension of bore dia. 35 $^{+0.09}_{+0.05}$ mm

True running deviation:
0.028 ... 0.032 mm

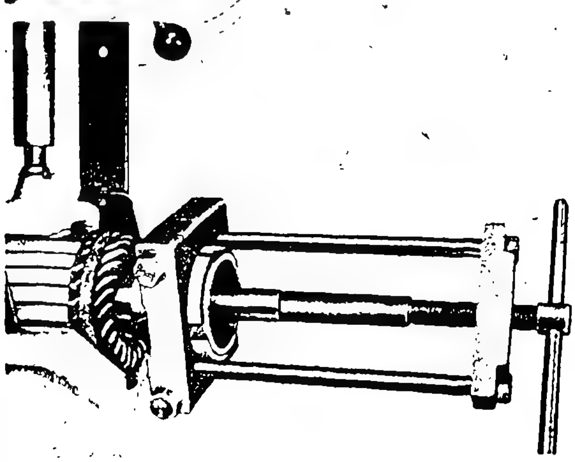
Check dimension "X". If necessary rework by facing.

Dimension "X"
0 001 400 401
.. 402 15 ± 0.02 mm
.. 500 501 8 ± 0.02 mm
.. 501 .. (QD 6/24 AR 172 to 176)
7.5 ± 0.02 mm
.. 501 .. (QD 6/24 AR 161, 181, LS 103)
39 ± 0.03 mm

12

Slip closing cover, rubber gasket with spring washer and helical spring over pinion via helical spline. Insert pinion into drive end shield (pay attention to lubricating felt!) and screw on closing cover.

Fill bore 2 in drive end shield with oil VS 12 037. Screw in stud (Fig. 10).



13

4.4 Multiple plate clutch

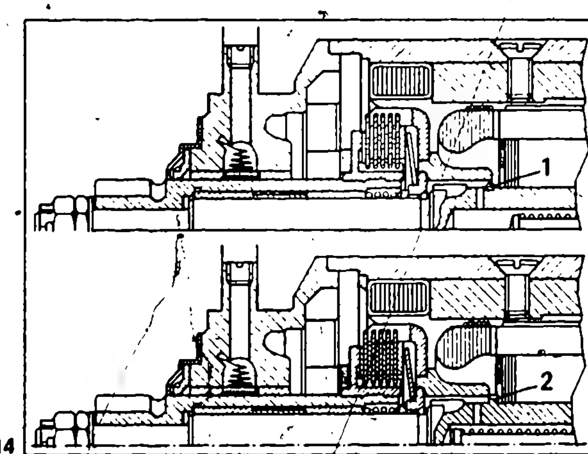
Examine drive flange for damage, if necessary replace using puller and forcing-on device.

Drive flange jaw inner dia.
old design 75 mm
reinforced design 79 mm

Insert (pressure) thrust ring into the drive flange.
Oil all sliding surfaces well (thread, press fit, support).

For this purpose insert armature with screwed-in return spring bolt into supporting tool c. Armature then rests on round nut of return bolt. Never set down on commutator.
Older versions of KG starting motors (manufactured before 1958) are provided with a collar stop on the armature shaft instead of the retainer used nowadays. Drive flange 2 006 490 023 should be used for these starting motors (Fig. 14).

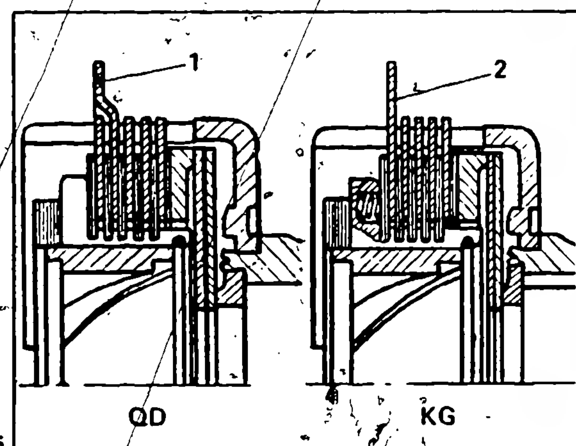
1 = retainer
2 = collar stop



14

Dismantling
Remove retainer from pressure sleeve. Remove thrust ring, shims and spring washers from drive flange. Clean parts in benzine. Replace damaged discs and spring washers (perform resonance test).

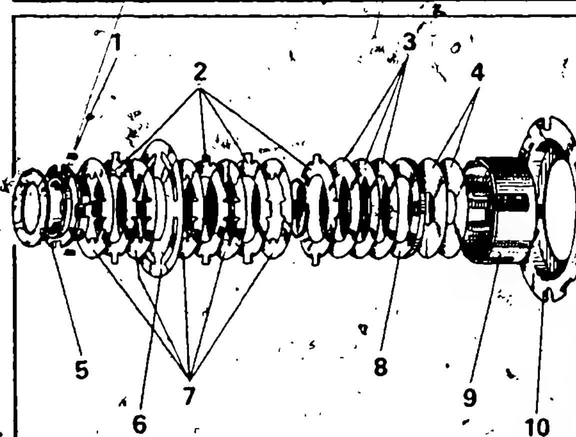
QD 1 = Stop disc (dish-shaped) placed fourth.
KG 2 = Stop disc placed second (Fig. 15).



15

Assembly
Assemble clutch as shown.
Slightly grease pressure sleeve, helical spring, discs, thrust ring and spring washer with Ft 2 v 1 (see also lubrication chart, section 8).
Ensure correct sequence.
Thrust ring with collar towards armature winding.
Use new retainer in pressure sleeve and secure by caulking.
For QD starting motors slip support ring over drive flange before assembling (Fig. 16).

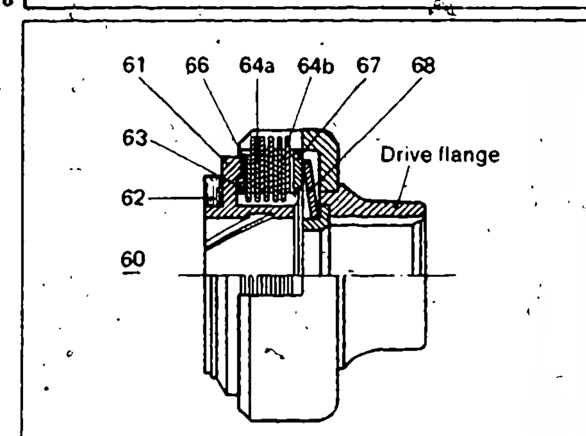
1 = Helical spring
2 = Tombak discs
3 = Shims
4 = Spring washers
5 = Pressure sleeve
6 = Stop disc (dish-shaped)
7 = Steel discs
8 = Drive flange
9 = Thrust ring
10 = Support ring



16

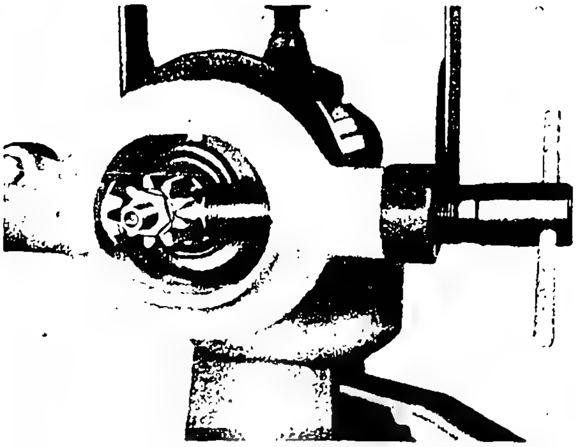
Use only reinforced clutch for KG starting motors as of FD 325 (5.73) (Fig. 17).

60	Multiplate clutch, complete
61	Pressure sleeve
62	Stop ring
63	Corrugated spring
64a	Disc, inner serration
64b	Disc, outer serration
66	Shims
67	Thrust ring
68	Disc spring



17

Insert pinion into drive end shield and place on armature shaft.
First screw flat nut with plain washer against collar on armature shaft by hand only.



18

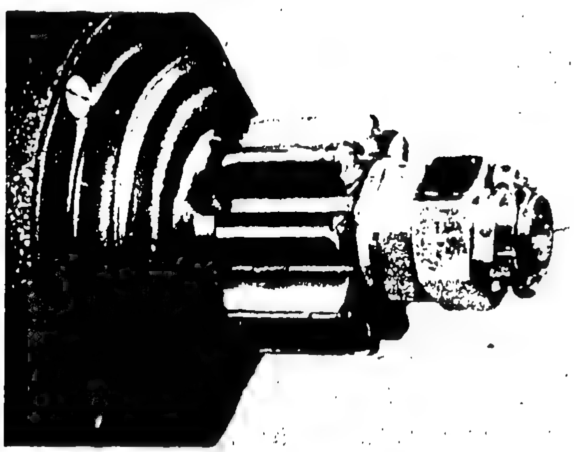
Testing slip torque (overload protection against motor kick-back)

Slip pre-assembled drive end shield together with pinion onto armature shaft. Screw on one nut. Attach torquemeter to pinion opposite to rotational direction of starting motor. Balance clutch discs by turning backwards and forwards. Attach torquemeter pan and add weights. The slip torque is reached when the torquemeter pan moves down on tapping the clamping device. Slip torque in kgfm = weight added in kgf plus weight of lever (shown on lever) = total weight in kgf x length of lever arm (1 m) = slip torque in kgfm. Multiply by 10 to convert to the new international unit Nm (newton-metre).

Inadequate slip torque – add shims.
Excessive slip torque – remove shims.
A 0.1 mm thick washer alters the slip torque by 30 to 40 Nm.

Nominal slip torque values:

KG starting motor, old –	120 ... 150 Nm	(12 ... 15 kgfm)
new –	130 ... 170 Nm	(13 ... 17 kgfm)
QD starting motor	140 ... 160 Nm	(14 ... 16 kgfm)



19

Having adjusted slip torque, screw nuts absolutely tight and lock.
1. Tighten flat nut against collar of armature shaft applying 30 ... 35 Nm (3 ... 3.5 kgfm).
2. Tighten castle nut against flat nut applying 16 ... 51 Nm (1.6 ... 5.1 kgfm).
3. Lock flat nut against castle nut applying 45 ... 51 Nm (4.5 ... 5.1 kgfm) so that split pin can be inserted through armature shaft and between slots in castle nut and then bent back (split).

4.5 Stator frame

Check excitation coils for proper seating.
Windings must not be burned or damaged, nor must they extend over pole shoes. Test all windings for open-circuit and short-circuit to chassis:

Test voltage for open-circuit 6 V DC

Test voltage for short-circuit to chassis:
12 V starting motor 40 V AC
24 V starting motor 80 V AC

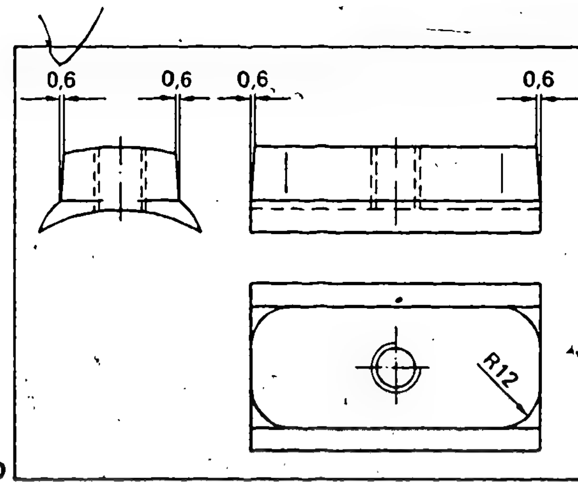
W-001/102

Measure resistance of auxiliary and holding windings (shunt winding) using ohmmeter.
See section 9 for resistance values.
Auxiliary winding: start white, end red.
Holding winding: start and end blue.

If in doubt remove windings and clean.
Test removed windings using test yoke.

With frayed windings inspect pole shoe edges.
Edge radius of pole shoes must be 12 mm. Otherwise rework as shown in drawing.

Slightly heat windings before installation. Pay attention to marking of pole shoes.
Insert force-in mandrel, tighten pole shoes.
Retest fitted windings for open-circuit and short-circuit to chassis.



20

4.6 Commutator end shield

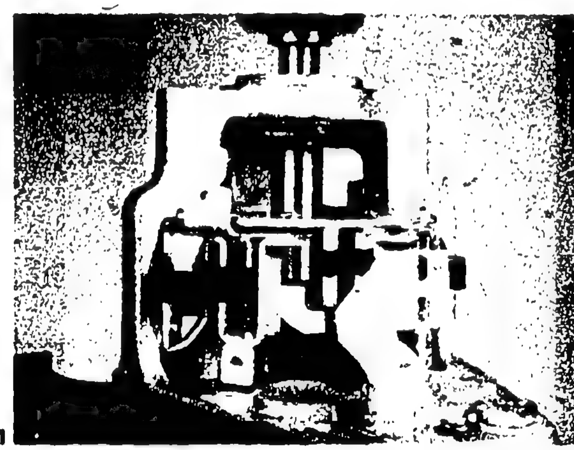
Test insulated brush holders and terminal studs for short-circuit to chassis.
Replace damaged helical compression springs. Insert new helical compression springs so that they can be loaded with half a turn. Replace brush holders which have short-circuit to chassis and loose brush holders.

Replace bearing pin:
Push bearing pin through on press using a suitable mandrel.
Place new pin in position from interior, align bores in accordance with threaded holes in commutator end shield and force in pin on press.

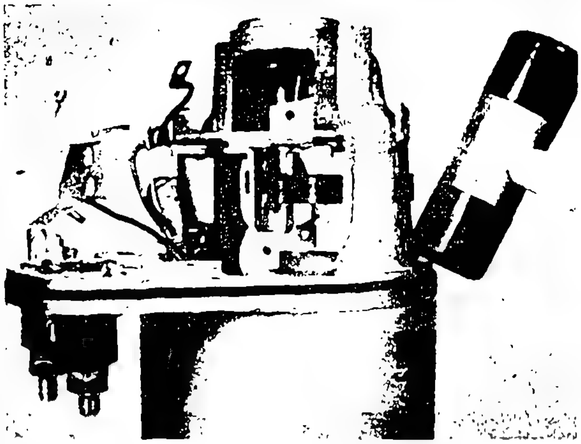
Tighten screws, caulk and press on new friction washer.

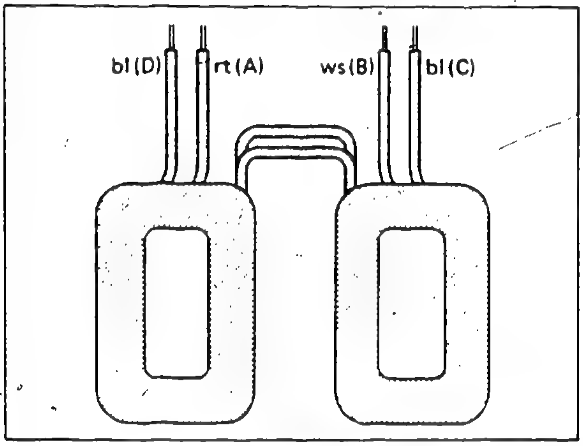
4.7 Relay (control relay)

Replace burnt or damaged relays.
Check for good chassis connection in case of relays with earthed winding end.

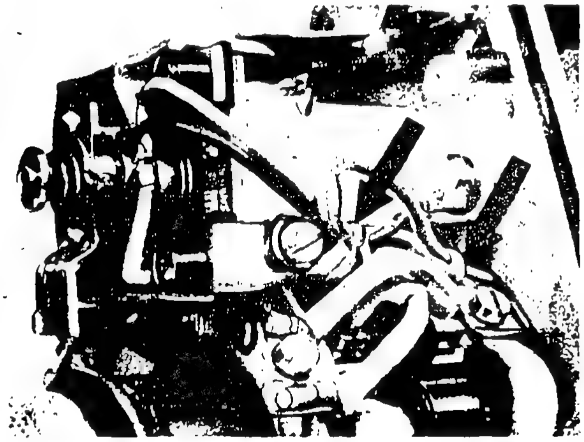


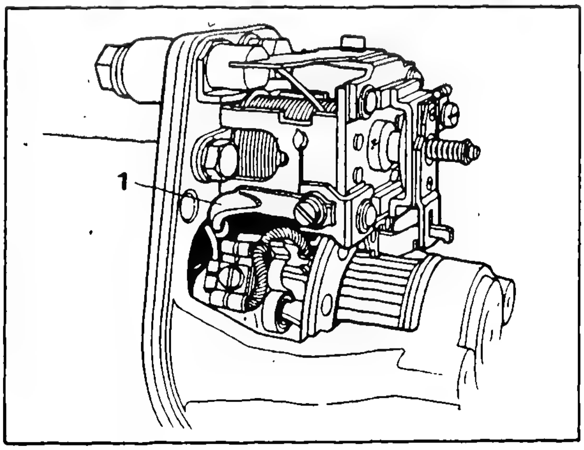
21


22



23


24



25

5. Assembly

Insert busbars and place commutator end shield on stator frame. Pay attention to locating lug.
Route connecting cables so that laminated armature core does not catch, and so that short-circuits are avoided.

Insert armature with drive end shield into stator frame and screw together.

Screw nut on guide pin, if necessary holding guide pin steady with screwdriver.

Renew housing seal ring if damaged.
Screw starting motor relay to commutator end shield.
See section 7 for circuit diagrams.
Insert carbon brushes.

Brush pressure:
KG starting motor 12 ... 15 N (1.2 ... 1.5 kgf)
QD starting motor 14 ... 16 N (1.4 ... 1.6 kgf)

bl = blue
rt = red
ws = white

Solder winding end of relay coil to terminal 50 and solder insulated return, if provided, to terminal 31 or 61. Connect relay on joining bar to terminal 30.

Connect winding ends as follows:
Holding and auxiliary windings (blue (C) and white (B)) cables together, in later design combined white cable, to current bridge; auxiliary winding (red (A) cable) to insulated positive brush and auxiliary winding (blue (D) cable) to negative brush (leads to terminal 31) or to positive brush in standby power units. Direction of rotation (with old models only) can be changed by reversing auxiliary winding ends (white and red) and holding winding ends (blue, blue).

In the case of starting motors with insulated ground return a busbar bridges the negative brushes, while a second busbar bridges the positive brushes, whereas in starting motors without insulated ground return only one busbar bridges the insulated positive brushes.
Connect field bars on relay and brush holder. Firmly connect auxiliary and holding windings to busbar (see arrow).

5.1 Conversion to vibration-proof starting motors

Starting motors 0 001 401 .. and 0 001 402 .. can be fitted with a vibration-proof relay (0 331 101 001, .. 002, .. 003, .. 004 or 0 331 100 020). For this purpose the ends of the excitation winding must be shortened approx. 7 mm by bending a loop.

1 = bend loop

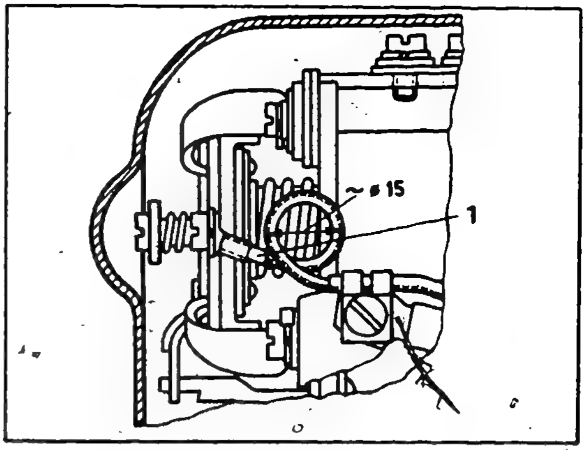
Non vibration-proof relays (0 331 100 012, .. 013, .. 014, .. 015) cannot be fitted to starting motors provided with the new relay since the field windings have already been shortened.

Fit starting motors 0 001 401 007, .. 049 and .. 066 (vibration-proof models) with winding 2 004 105 015. Bend loop of approx. 15 mm dia. and provide cable with additional support using electrical terminal 1 901 350 005, connecting with excitation winding end to relay busbar. Coils of loop must not touch or chafe. Do not forget plain washer and retainer.

1 = insulating tube

Current bridge must still switch perfectly. Fit starting motors 0 001 401 007 and 0 001 401 049 with vibration-proof relays and vibration-proof carbon brushes 2 004 320 092. After conversion mark starting motor with number of vibration-proof starting motor 0 001 401 070.

Control relay with negative to terminal 31.
Coil wire should be attached to the joining bar behind the soldered joint as shown in the drawing and secured with adhesive (e.g. "Uhu-Plus").



26

6. Testing of assembled starting motor

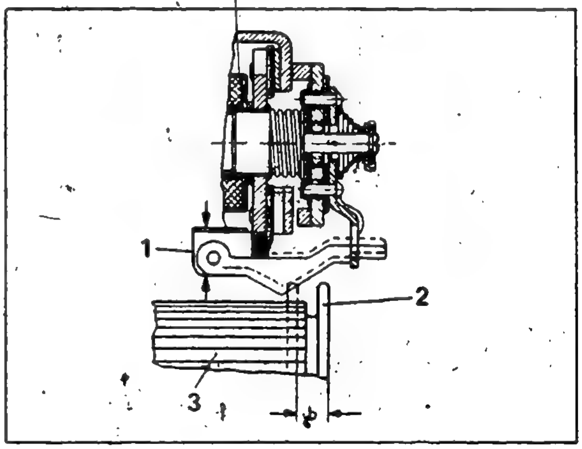
Test relay with increased rated voltage (16 V instead of 12 V and 32 V instead of 24 V) at terminal 50 (terminal 30 not connected) and energize about 5 times. Only switch position 1 should engage, i.e. release lever should not disengage.

Trigger path "b"
Connect terminal 50 of relay with battery + (rated voltage).
Switch position 1 engages: Move armature (e.g. using screwdriver) until relay jumps to switch position 2.

Dimension "b"
KG starting motor 12 ... 14.8 mm
QD starting motor 15.8 ... 18.4 mm

Dimension "b" can be readjusted by bending bearing bracket of release lever (see arrows).

1 = Bearing bracket
2 = Tripping disc
3 = Commutator



27

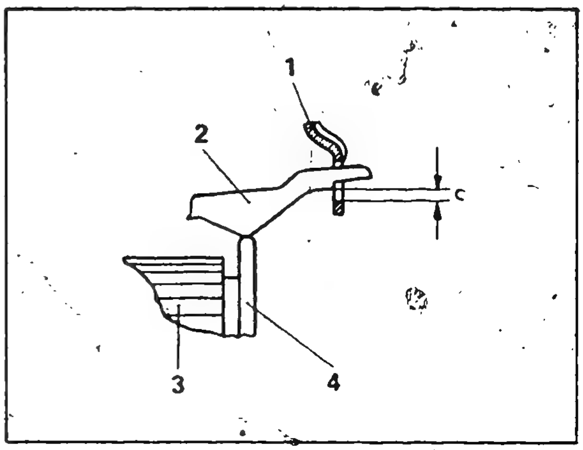
Minimum lift "c"

Move armature until release lever is at highest point of tripping disc.

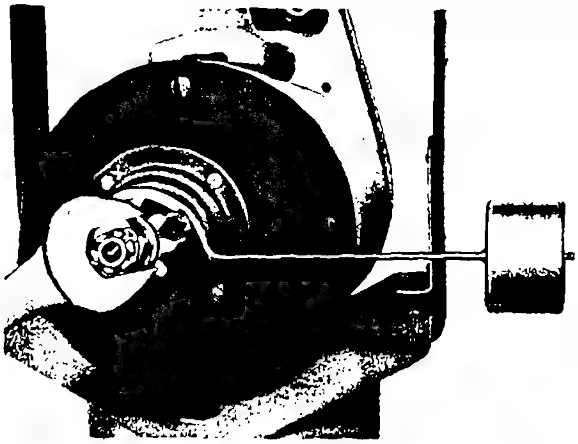
Measure dimension "c" using feeler gauge.
KG starting motor at least 0.75 mm
QD starting motor at least 0.95 mm

Dimension "c" can be increased or decreased by bending stop plate on moving contact of control relay.

1 = Clip on relay moving contact
2 = Release lever
3 = Commutator
4 = Tripping disc

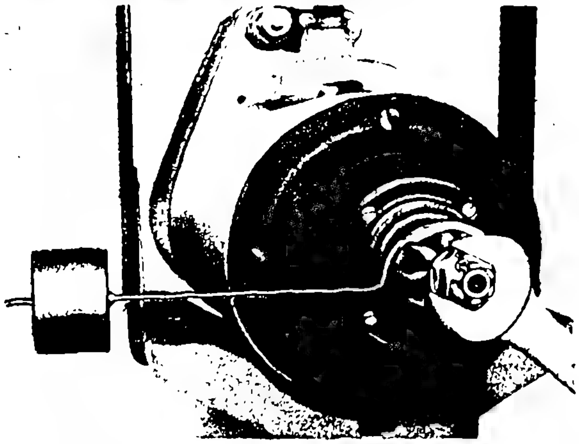


28



29

Set to initial meshing stage (applies only to clutches before FD 325).
Advance armature 6 ... 8 mm. Measure torque using KDAL 5485 against **rotational direction of starting motor.**
KG starting motor 0.4 ... 0.6 Nm (4 ... 6 kgfcm)
QD starting motor 0.6 ... 0.8 Nm (6 ... 8 kgfcm)



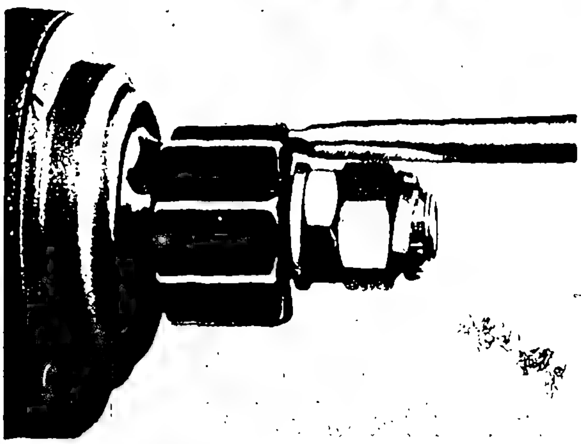
30

Overrunning torque
Attach torquemeter to pinion. In clutches up to FD 325 pinion must have moved forwards at least 10 mm. Measurements are to be taken in the **rotational direction** of the starting motor. Use a spanner to hold the armature steady.

Nominal value

old clutch	0.75 ... 0.95 Nm (7.5 ... 9.5 kgfcm)
new clutch	0.75 ... 1.05 Nm (7.5 ... 10.5 kgfcm)

Perform electrical test on test stand.
See VDT-WPE 510/207 B for test specifications.
Fit closing cover and repeat test.



31

Pinion axial clearance
KG starting motor at least 0.5 mm
QD starting motor at least 0.3 mm
Pinion axial clearance can be adjusted by means of shims (see service parts microfiche) at pinion end face.

If the axial clearance is inadequate the drive flange has not been fully pressed on, the wedge preventing the drive flange from turning has been pushed out to the rear or the multiplate clutch has not been assembled properly (see section 4.4, Fig. 14).

If the minimum axial clearance is not achieved after correcting these faults, a different pinion/multiplate clutch combination should be selected.

W-0041 102

7. Circuit diagrams

For **windings with 3 connections** (new design) white is connected to moving contact, red to positive brush, blue to negative brush. Change of rotational direction is not possible.

For **windings with 4 connections** (old design, see Fig. 23) the rotational direction can be changed by reversing the auxiliary and holding winding connections.

Clockwise

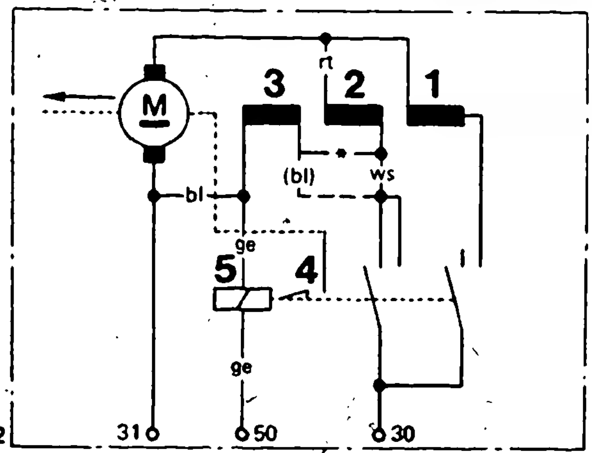
auxiliary winding	red to + brush
	white to moving contact
holding winding	blue to moving contact
	blue to − brush

Anti-clockwise

auxiliary winding	red to moving contact
	white to + brush
holding winding	blue to moving contact
	blue to − brush
	reverse both blue connecting cables (compared to clockwise connection)

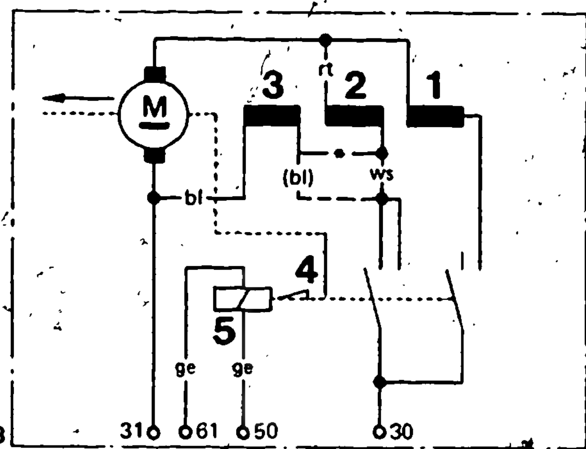
1 = Series winding
2 = Auxiliary winding (auxiliary excitation winding)
3 = Holding winding (shunt winding)
4 = Tripping lever
5 = Control relay

For windings with 4 connections the cable marked with dashes (- - -) replaces the cable marked with an asterisk.



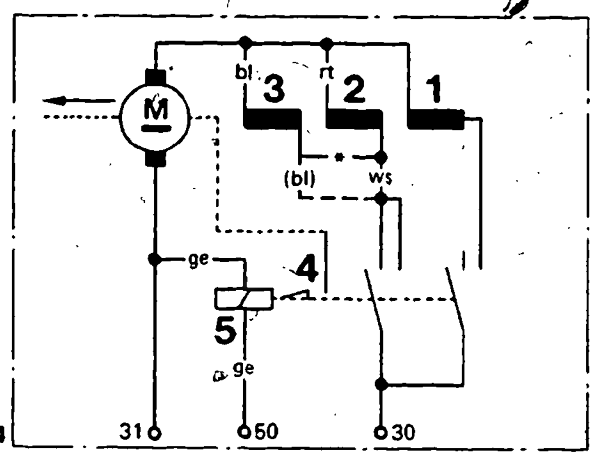
32

Fig. 32
Starting motors – general
Starting motor designs with and without terminal 31



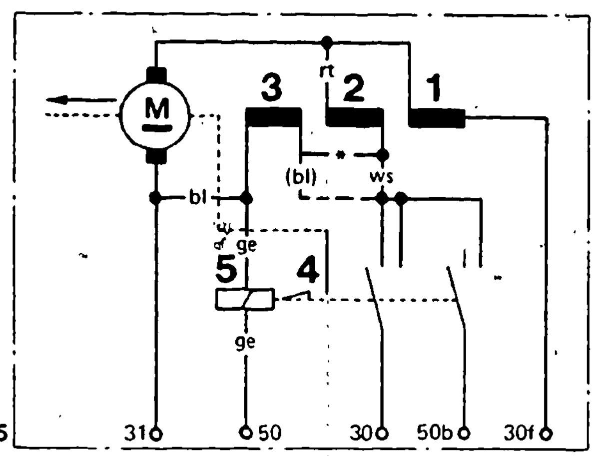
33

Fig. 33
Starting motor 0 001 501 044 – QD (R) 24 V 6 PS
045 – QD (R) 24 V 6 PS



34

Fig. 34
Starting motor for standby power units with automatic cut-in



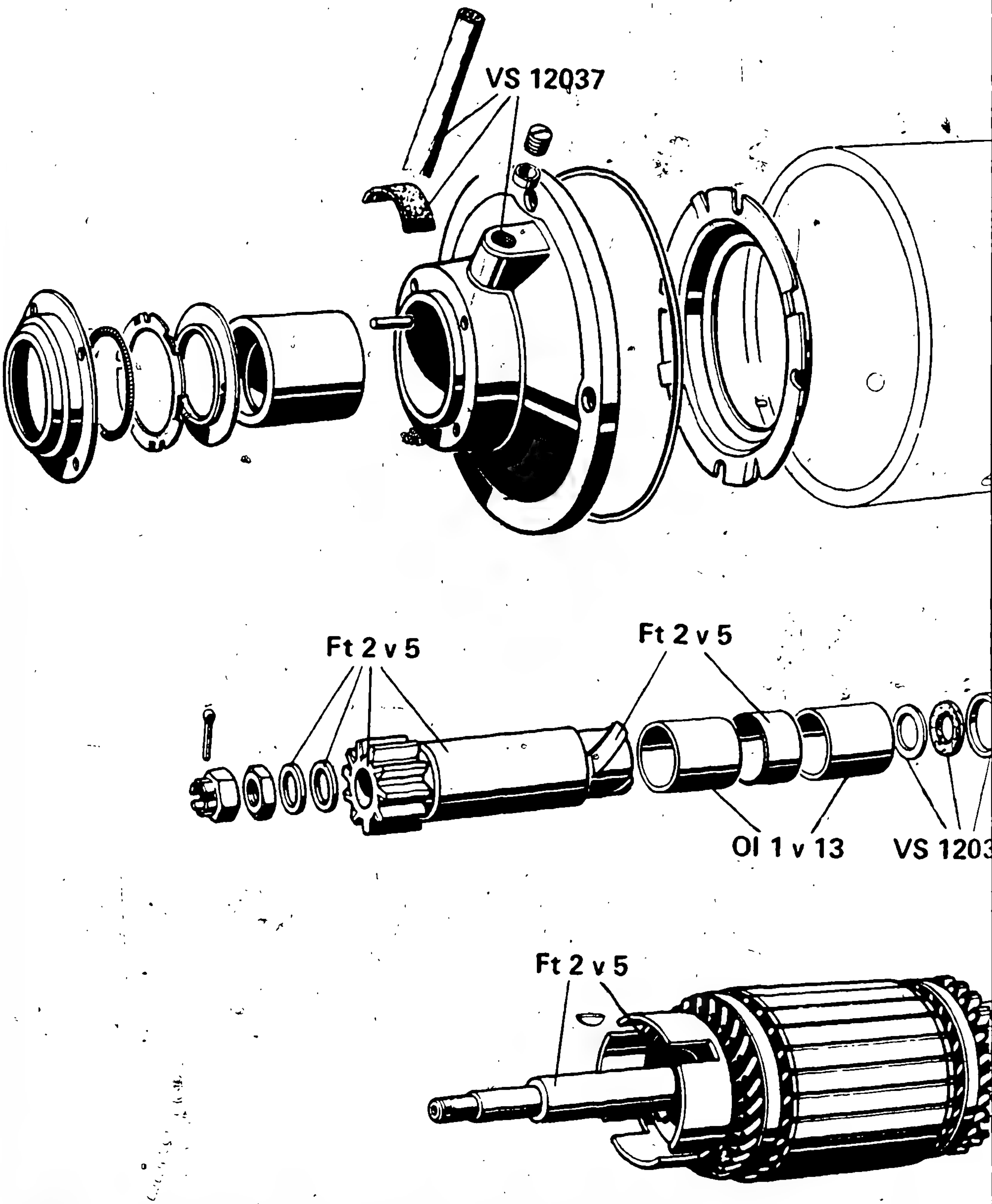
35

Fig. 35
Parallel-operation starting motors
0 001 402 065 – KG (R) 24 V 4 PS
066 – KG (R) 24 V 4 PS

bl = blue
ge = yellow
rt = red
ws = white

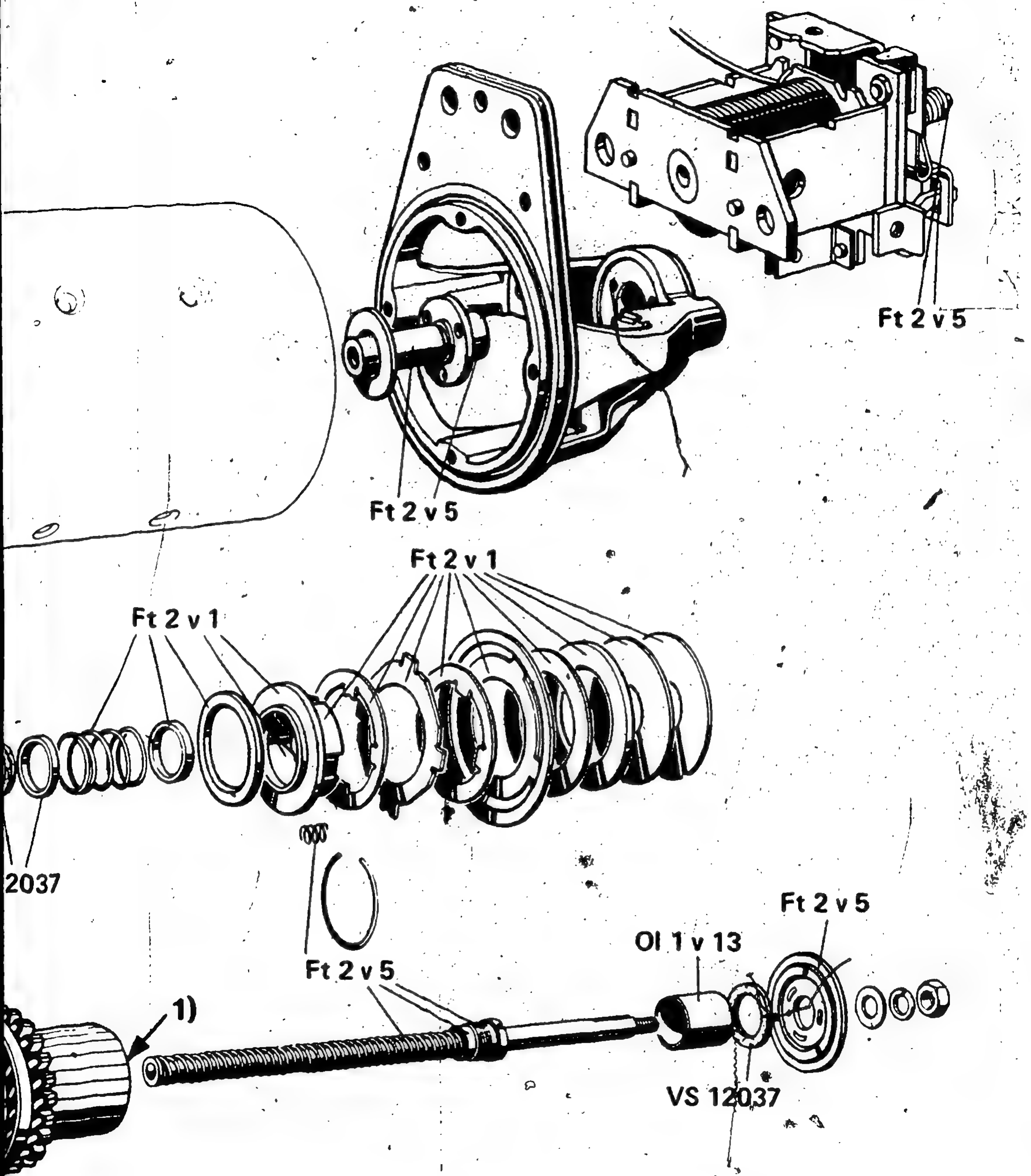
M17

8. Lubrication chart



[1]) Grease cavity with Ft 2 v 5

Sait M 18



M 19
~~Seite~~ 15

9. Technical data

	KG	QD
Minimum commutator diameter	45 mm	59 mm
Brush pressure	12 ... 15 N (1.2 ... 1.5 kgf)	14 ... 16 N (1.4 ... 1.6 kgf)
Armature travel	24 ... 26 mm	
True running deviations of commutator	≤ (max.) 0.03 mm	
of laminated core	≤ (max.) 0.05 mm	
Pinion friction torque	0.14 ... 0.23 Nm (1.4 ... 2.3 kgfcm)	
Pinion axial clearance	≥ 3.0 mm	
Trigger path "b" for relay	12 ... 14.8 mm	15.8 ... 18.4 mm
Wear reserve "c" for release lever	≥ (min.) 0.65 mm	≥ (min.) 0.85 mm
Armature-return spring pre-load	see test specifications sheet VDT-WPE 510/207 B	
Multiplate clutch		
Overrunning torque	0.75 ... 0.95 Nm (7.5 ... 9.5 kgfcm)	
Initial stage	0.4 ... 0.6 Nm (4 ... 6 kgfcm)	0.6 ... 0.8 Nm (6 ... 8 kgfcm)
Overload protection (slip torque)	130 ... 170 Nm (13 ... 17 kgfm)	140 ... 160 Nm (14 ... 16 kgfm)

Resistance values of auxiliary and holding windings

Starting motor	Resistance values Auxiliary winding Ohms	Holding winding Ohms
0 001 400 .. – BNG 2.5/12..	0.14	0.20
0 001 401 .. KG 12 V 4 PS BNG 4/12..	0.14	0.20
0 001 402 .. KG 24 V 4 PS BNG 4/24	0.50	0.90
0 001 501 .. QD 24 V 6 PS BPD 6/24 A..	0.23	0.73
0 001 501 023 QD 24 V 6 PS BPD 6/24 AR 168	0.36	1.5
0 001 501 034 QD 24 V 6 PS BPD 6/24 AR 179	0.36	1.5

10. Further technical documentation

KH/VDT EE..	Service parts microfiche
VDT-WJA 021/2 D	Fitting of-self-lubricating bushings
VDT-WJA 021/3 B	Replacing excitation windings
VDT-W-001/100 B	Repair instructions for submersible starting motors
VDT-WPE 510/2 B	Test instructions for starting motors
VDT-WPE 510/207 B	Test specifications for starting motors
VDT-WPE 510/2-11 B	Test specifications (circuit diagrams)
VDT-WUE 513/3 D	Fitting terminal 48
VDT-WPE 712/1 D	Test instructions for relays
VDT-WPE 712/1-1 D	Test specifications for relays

M20

0 001 410 ..-KB (R) 24 V 6 PS and
0 001 411 ..-KB (R) 24 V 6,5 PS
Modification to drive spindle 2 003 162..

00
VDT-I-001/112 B
Ed. 1 10. 1975
Translation of German
edition of 13.10. 1975

As from FD 622 (Febr. 1976), the drive spindles

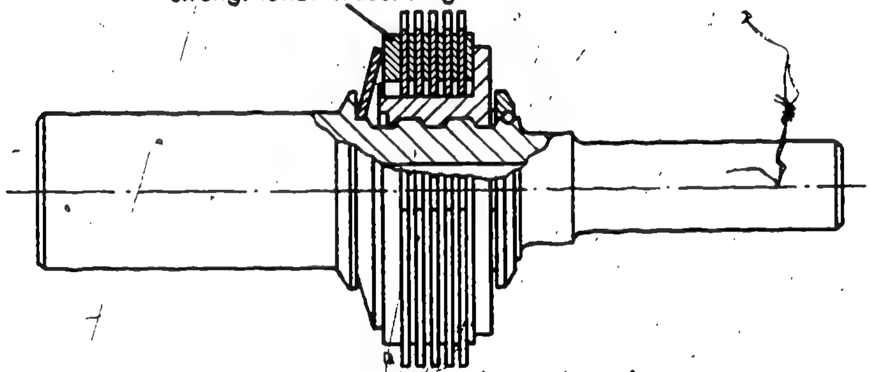
2 003 162 013, ..016 and ..017

and the repair parts sets

2 007 010 037 and ..038

will be modified. The part number will not change. The modified spindles are interchangeable with the superseded models.

In future only 5 steel laminations (2 001 189 014) will be fitted instead of 6. To compensate for this missing lamination, a stronger thrust ring will be fitted (3.6 mm instead of 2.2 mm) which will also be provided with driving lugs. The part number changes from 2 000 102 004 to 2 001 189 015.



In case of enquiry, please contact your authorized representative.

Published by :
Trade Division K1
Dept. K1/VAK 6

M21

BOSCH
Geschäftsbereich KH Kundendienst Kfz-Ausrüstung
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

M21

0 001 410 .. - KB 24 V 5.5 kW (formerly 6 HP)
0 001 411 .. - KB 24 V 6.5 kW (formerly 6.5 HP)
0 001 510 .. - QB 24 V 9.0 kW (formerly 9 HP)
Introduction of various improvements

Starting motor types "KB" and "QB" have been updated to bring them into line with present-day automotive technology. This has resulted in the following alterations:

Summary:

<u>KB and QB starting motors</u>

1.) As from FD 623 (March 1976) the engagement rod has been altered in non-oil-protected KB starting motors. For oil-protected KB starting motors and all QB starting motors it is intended that the altered engagement rod be introduced as from FD 626 (June 1976).

<u>KB starting motors</u>

2.) The brush pressure has been increased as from FD 531 (Nov. 1975).

3.) The solenoid switches 0 331 450 001 and ..002 have been altered as from FD 531 (Nov. 1975). The former solenoid switch 0 331 450 004 was prohibited at the beginning of 1976 and has been replaced by 0 331 450 001.

4.) As from FD 621 (Jan. 1976) the first commutator-end shields without carbon brushes have been supplied as service parts. This changeover will have been completed by FD 624 (April 1976).

5.) As from FD 623 (March 1976) the pole shoe screws have been changed from M8 to M10.

6.) As from FD 623/624 (March/April 1976) the pressure sleeve in the drive spindle and the drive housing of the armature have been altered.

7.) As from FD 623 (March 1976) starting motor 0 001 411 009 has been converted to relay 0 331 101 006. This relay will also be fitted in the remaining starting motors 0 001 411 ... Please observe this during repair work.

<u>In detail:</u>

1.) The following modifications have been made to the engagement rods:

- No longer a groove on the threaded part
- Stop for drive spindle changed from a wire ring to a swaged collar.
- Thread for pinion fastening nut changed from M10 x 1 to M10 x 1.5

M 22

BOSCH

Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung.

- A knurl in front of the collar serves to prevent the engagement rod being turned out of position with regard to the pinion during assembly
- Locking washer 2 000 146 or 2 000 147 010 is dropped
- The countersink for the locking washer on the front-side of the pinion is dropped, except in a case of replacement

The part numbers of the engagement rods have been changed and for repair purposes the following parts sets have been laid down:

Engagement rod old	Engagement rod new design		Parts set
2 003 050 056	2 003 050 075	KB starting motor	2 007 010 045 comprising: 1 engagement rod 2 003 050 075; 1 flat nut 2 915 051 108; 1 uni-stop nut 2 003 315 001
2 003 050 060	2 003 050 079	KB starting motor protected against hydraulic oil	2 007 010 046 comprising: 1 engagement rod 2 003 050 079; 1 flat nut 2 915 051 108; 1 uni-stop nut 2 003 315 001
2 003 050 054	2 003 050 077	QB starting motor	2 007 010 048 comprising: 1 engagement rod 2 003 050 077; 1 flat nut 2 915 051 108; 1 uni-stop nut 2 003 315 001
2 003 050 064	2 003 050 078	QB starting motor protected against hydraulic oil	2 007 010 049 comprising: 1 engagement rod 2 003 050 078; 1 flat nut 2 915 051 108; 1 uni-stop nut 2 003 315 001

M 23

|| If engagement rods are ordered, parts sets will be delivered. ||

Assembly as per fig. 1: The knurl on the starting motor engagement rod is pulled into the drive spindle bore by means of the flat nut, and both nuts are tightened up, one after the other, with the specified torque. The uni-stop nut must be renewed every time the starting motor is repaired.

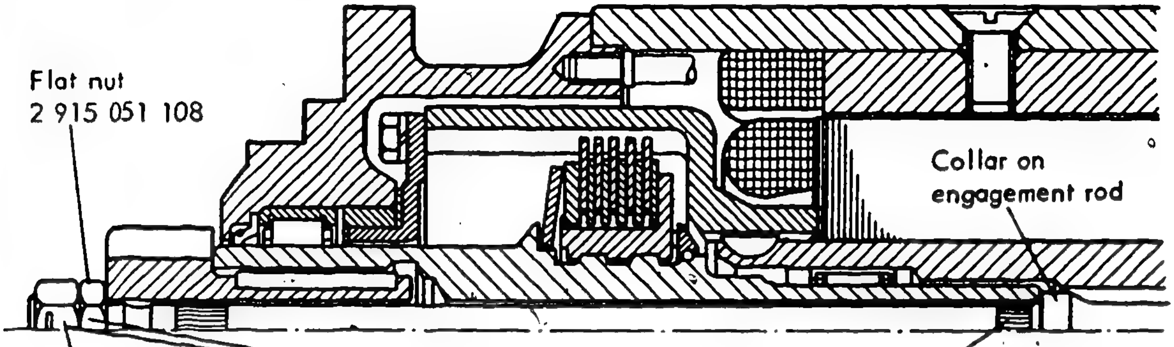


Fig. 1

For the repair of starting motors with the old engagement rods, locking washers 2 000 147 010 and 2 000 146 000 can be supplied as before.

2.) The brush pressure has been changed from ~~13~~ + 1 N (1.3...1.4 kgf) to a maximum of 25 N (2.5 kgf), thereby achieving longer brush life expectancy.

The part number for the brush springs 2 004 652 006 has not been changed.

3.) Since FD 531 (Nov. 1975) firmer seating of the pull-in and holding windings has been achieved in solenoid switches 0 331 450 001 and ..002 by the use of plastic bobbins, the bobbin diameter thereby becoming larger. The switch part numbers have not been changed.

In order that the tripping lever of relays 0 331 101 005, ..006, ..008 and 009 does not contact the solenoid switch winding, as from FD 624 (April 1976) the shape of the tripping lever is being changed and the longitudinal slit in the stop plate is being moved upwards by 1.5 mm.

The relay trigger point (primary current delivery) remains unchanged.

If a new solenoid switch (with plastic bobbin) is used together with an old relay, the distance between the solenoid switch winding and the tripping lever must be at least 1 mm (see fig. 2). If this cannot be attained, the two relays in their locations must be pushed as far apart as possible. If necessary the locating pins of the relay must be removed (not those of the solenoid switch - leads the misalignment).

Otherwise the adjustment data given in repair instructions VDT-W-001/101 B Fig. 45 must be observed.

The part numbers of the two parts sets 2 007 010 037 and ..038 used when repairing the drive spindle and the armature have not been changed.

Repair instructions VDT-W-001/101 B, Ed. 3 continue to be applicable for the repair of drive spindles.

In case of inquiry, please contact your authorized representative.

M25

I-0011113B
Stiles

Commutator end schields with carbon brushes (old)	Commutator end shields without carbon brushes (new)
2 005 855 077 124 095	175
2 005 855 132	174
2 005 855 078 135	173
2 005 855 142	172
2 005 855 129 162	171

Carbon brushes must thus be ordered separately, if required.

5.) As from FD 623 M10 pole shoe screws (part no. 2 910 551 287) will be used instead of M8 pole shoe screws (part no. 2 910 551 240) which have been in use up till now.

M8 pole shoe screws (part no. 2 910 551 240) are still obtainable.

6.) As from FD 623/624 (March/April 1976) the pressure sleeve of the drive spindles 2 003 162 013, ..016 and ..017 and the armature drive housing are extruded parts.

The pressure sleeve part numbers have been changed from

2 006 449 011 to 2 006 436 004 (clockwise rotation)

and from 2 006 449 012 to 2 006 436 005 (counterclockwise rotation)

The

4 straight pins 2 917 520 094 and the

4 springs 2 004 610 021

previously delivered together with the pressure sleeve must in future be ordered separately.

The diameter of the pressure sleeve has been changed from 45.5 to 46.0 mm (see fig. 3) which necessitates a change in the hole diameter of the shims from 45.5 to 46.0 mm.

The shim part numbers have been changed from 2 000 102 039 up to ..045 to 2 000 102 153 up to ..159.

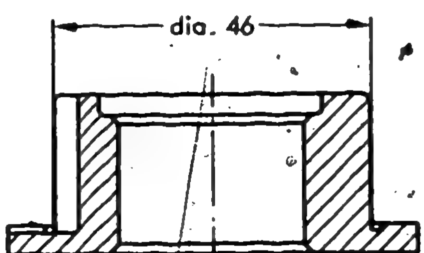


Fig. 3

M 26

D2n

C5

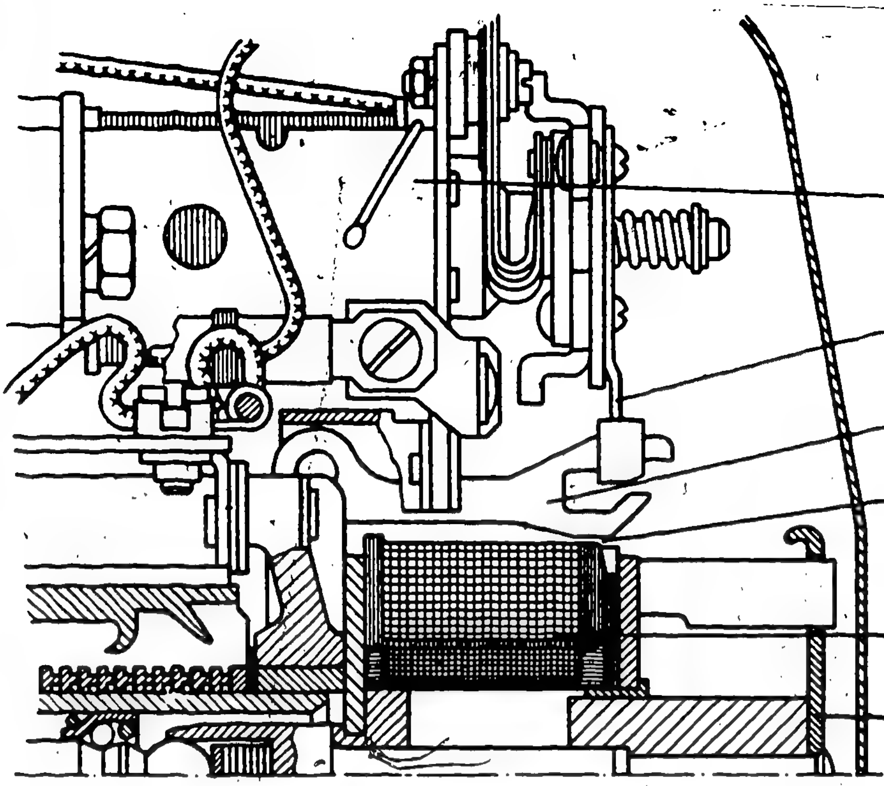


Fig. 2

4.) Commutator end shields without carbon brushes have started to be introduced for use as service parts as from FD 62J (Jan. 1976), and as from FD 624 (April 1976) all will be without carbon brushes.

Cross-reference below:

Commutator end shields with carbon brushes (old)	Commutator end shields without carbon brushes (new)
2 005 855 073 099	2 005 855 170
2 005 855 146	169
2 005 855 076 149 and ..085	168
2 005 855 150	167
2 005 855 110 137 161	166

M 27

Modifications to Commutator End Shield and Intermediate Bearing

00

VDT-I-001/113 B
Suppl. 1
9. 1976

in Starting Motors 0 001 410 .. – KB 24 V 5.5 kW
411 .. – KB 24 V 6.5 kW
510 .. – QB 24 V 9.0 kW

Summary

KB and QB starting motors

1. Alteration of connection on terminals 48 and 50 to M6 terminal stud, as from FD 624 (April 76), in order to reduce voltage drops. To be introduced gradually.

2. Use of a self-locking screw to mount the intermediate bearing (item 53 or 62 on service parts microfiche) on the armature drive housing, as from FD 626 (June 76).

3. QB starting motors only: Strengthening of the commutator end shield by means of a fourth segment, as from FD 627 (July 76).

1. Conversion of commutator end shield to M6 terminal stud

1.1 KB starting motors

All commutator end shields are being converted to M6 terminal studs.
Exception: Commutator end shield 2 005 855 171 with terminal 48 for connection of a start-repeating relay.

The following end shields are thus superseded by others, already in production, with M6 terminal studs.

old Commutator end shield	new Commutator end shield with M6 terminal studs
2 005 855 168	2 005 855 165
170	166
175	174

Commutator end shields 2 005 855 167, ..169, .. 172, ..173 have been modified to M6 terminal stud connections; their part numbers remain however unchanged.

For purposes of repairing the starting motors the respective terminal-parts sets for terminal 50 or terminals 48 & 50 (item 201) are available:

2 007 011 000 (Terminal connection - terminal 50)
2 007 011 011 (Terminal connection - terminals 48 & 50)
2 007 011 029 (M6 terminal stud - terminal 50)

H 28

1.2. QB starting motors

All commutator end shields have been converted at terminals 48 and 50 to M6 terminal studs, the part numbers remaining unchanged. For purposes of repairing the starting motors the respective parts sets for terminals 48 and 50 (item 201 on the service parts microfiche) are available:

2 007 011 010 (Terminal connection - terminal 50)
2 007 011 049 (M6 terminal stud - terminal 50)
2 007 011 011 (Terminal connection - terminal 48)
2 007 011 050 (M6 terminal stud - terminal 48)

2. Fastening screws for the intermediate bearing in KB and QB starting motors.

Self-locking screws 2 003 450 015 (item 53 or 62 on the service parts microfiche) have been used for fastening the intermediate bearing (item 53 or 62 on the service parts microfiche) on the armature drive housing since FD 626. The spring lock washer 2 916 639 004 previously required has been dispensed with in series production. The thread length in the drive housing has been changed from 11.5 + 1 to 12.5 + 1 mm.

New self-locking screws must be used in a case of repair.
If none are available, ordinary screws should be used together with spring lock washers.
Because of the short thread length in starting motors made before FD 626, spring lock washers must always be used, even when self-locking screws are being fitted.
The screw should be tightened up with 7-8 N.m (0.7-0.8 kgf.m) of torque.

3. Commutator end shield - QB starting motor

As from FD 627 a fourth segment has been introduced on the commutator end shield to strengthen it.
This has not resulted in the end shield's number being changed.

A longer fastening screw (item 42 on the service parts microfiche) 2 911 061 209 (40 mm long) is used for fastening the commutator end shield (Fig. 1).

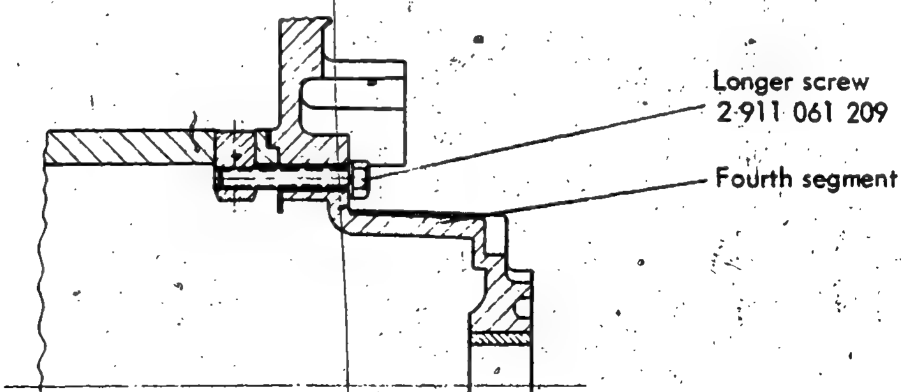


Fig. 1

N1

CHANGE OF PART NUMBERS ON DRIVE SPINDLES

2 003 162 013
2 003 162 016
2 003 162 017
for KB-starter 0 001 410 ...
0 001 411 ...
0 001 413 ...
0 001 414 ...
0 001 415 ...

From date of manufacture FD 832 the part numbers on drive spindles change as follows:

Former designation (drive spindle)	New designation (multi-plate clutch)
2 003 162 013	2 006 401 528
2 003 162 016	2 006 401 527
2 003 162 017	2 006 401 529

The multi-plate clutches with the new part number are interchangeable. When the starter has to be repaired, the complete multi-plate clutch must be replaced.

When this change is made the drive spindle or multi-plate clutch is marked with the BOSCH armature. In cases of guarantee claims it is therefore easier to distinguish them from non-Bosch multi-plate clutches.

N 2

BOSCH Geschäftsbereich KH Kundendienst, Kfz-Ausrüstung.
C by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50 Printed in the Federal Republic of Germany
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH

N2

NEW ARMATURES FOR STARTING MOTORS 0 001 41.. (KB)

Change-over to 29-slot armature in all KB starting motors

The KB starting motor program has been optimized and revised. An KB starting motors have armatures with 29 slots. The starting motors

0 001 410 .. (KB 24 V 5.5 kW) and
0 001 411 .. (KB 24 V 6.5 kW)

were previously equipped with 25-slot armature and the starting motors

0 001 414 .. (KB 24 V 4.5 kW)
0 001 415 .. (KB 24 V 5 kW)
0 001 413 .. (KB 12 V 3.5 kW)

were previously equipped with 37-slot armatures.

With the change-over there is an increase in the power of the starting motors. The part numbers are also changed.

Previous designations	New designations
0 001 413 .. - (KB 12 V 3.5 kW)	0 001 418 .. - (KB 12 V 3.6 kW)
0 001 414 .. - (KB 24 V 4.5 kW)	0 001 416 .. - (KB 24 V 5.4 kW)
0 001 415 .. - (KB 24 V 5 kW) 0 001 410 .. - (KB 24 V 5.5 kW)	0 001 416 .. - (KB 24 V 5.4 kW) or 0 001 417 .. - (KB 24 V 6.6 kW)
0 001 411 .. - (KB 24 V 6.5 kW)	0 001 417 .. - (KB 24 V 6.6 kW)

Note the following when repairing the previous starting motors:

1. <u>Starting motors 0 001 410 .. and 0 001 411 ..</u>

   The 25-slot armature 2 004 005 151 is not allowed.
   The interchangeable 29-slot armature 2 004 005 025 is supplied as a replacement. The excitation windings 2 004 125 0.. are still available.

N 3

BOSCH
Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.
© by Robert Bosch GmbH, D-7 Stuttgart 1, Postfach 50. Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne par Robert Bosch GmbH.

N3

AS

2. Starting motors 0 001 413 .., 0 001 414 .. and 0 001 415 ..

The 37-slot armature 2 004 005 155 (12 V) and 2 004 005 153 (24 V) is replaced by the interchangeable 29-slot armature 2 004 005 026 (12 V) and 2 004 005 022 (24 V).

Both the previous as well as the new excitation windings of starting motors 0 001 416 .. and 0 001 418 .. can be used as excitation winding.

If using the 29-slot armature, a starting-motor solenoid with shunt field change-over switch (see list below) should be installed so as to guarantee proper meshing of the starting motor.

The following parts (1 of each) are required for connecting the shunt field change-over switch:

	for starting-motor version			
	12 V		24 V	
Service part designation	Ground return lead	Insulated return lead	Ground return lead	Insulated return lead
Starting-motor solenoid with shunt field change-over switch	0 331 450 009	0 331 450 010	0 331 450 001	0 331 450 002
Connecting cable	2 004 438 000	2 004 438 000	2 004 438 000	2 004 438 000
Connecting cable	-	2 004 438 002	-	2 004 438 002
NE field extension to shunt field change-over switch	2 004 438 006	2 004 438 006	2 004 438 006	2 004 438 006
Soldering sleeve for cable extension	Commercially available e.g. Stocko No. NR 132 MS		Commercially available e.g. Stocko No. NR 132 MS	

Further details on the wiring of the starting-motor solenoid can be taken from the repair instruction manual VDT-W-001 101.

Please direct questions and comments concerning the contents to our authorized representative in your country.

Initiator: K9/VAK

N4

N4

After-sales Service Instructions

Repair

00
VDT-W-001/101 B
Ed. 3
supersedes VDT-WJE 513/5 B

Starting Motors

KB 0 001 41..
QB 0 001 510..

BOSCH After-sales Service Automotive Equipment

N5

Contents

Automotive Equipment Division After-Sales Service
Department for Technical Publications KH/VDT
D-7 Stuttgart 1, Postfach 50

Questions and comments on the contents are to be directed to our authorized representative in your country.

Printed in the Federal Republic of Germany.
Imprimé en République Fédérale d'Allemagne
par Robert Bosch GmbH.
(11. 75).

W-0011 401

1. Test Equipment, Tools, and Lubricants

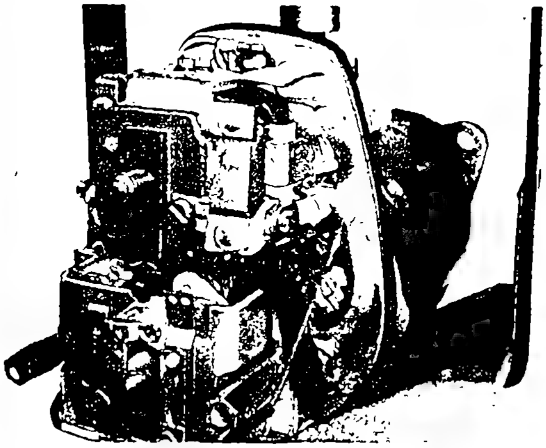
Test panel	EFAW 81 ..	0 681 ..
Transformer panel	EFAW 82 ..	0 681 ..
Interturn short-circuit tester	EFAW 90 ..	0 681 ..
or	EFAW 95 ..	0 681 ..
Torquemeter 1.5 ... 8 kgf m [15 ... 80 N·m]	KDAL 5485 (EFAW 26	0 681 400 001)
3.3 ... 30 kgf·m [33 ... 300 N·m]	KDAL 5476 (EF 2368 B	0 681 400 007)
Spring scale 0 ... 2.0 kgf [0 ... 20 N]	KDAW 9993 (EF 1244 B	0 681 400 006)
0 ... 16 kgf [0 ... 160 N]	(EF 5206	commercially available 1 688 130 009)
Dial indicator	EFAW 7	1 687 233 011
Magnetic instrument stand	T-M1 (EW/MS 1B1	4 851 601 124 0 601 980 001)
Ohmmeter		commercially available
Clamping support	KDAW 9999 (EFAW 9	0 681 269 007)
Undercutting saw [Commutator saw]	KDAW 9998 (EFAW 10	0 681 269 008)
Puller for bushings in armature	KDAL 5492 (EFAL 39	1 688 110 010)
Spring collet, diameter 18.1 for bushings in armature [Needle-roller bearing change]	KDAL 5492/0/7 (EFAL 101	1 680 715 000)
Press-in mandrel for needle-roller bearing KB armature	KDAL 5479 (EFAL 99	1 683 120 020)
QB armature	user fabrication*)	
Press-out and press-in tool for bushings and roller bearing in drive-end bearing housing for KB	KDAL 5003	
(press-out mandrel	EFAL 82	1 683 120 019)
for QB (press-in mandrel	EFAL 125	1 683 218 004)
Press-out and press-in mandrel for bushing in commutator end shield KB starting motor	KDAL 5481 (EFAL 106	1 683 124 060)
QB starting motor	user fabrication*) (EFAL 123	1 683 124 058)
Thrust member for armature on the undercutting saw KB starting motor	KDAL 5489 (EFAL 103	1 680 020 015)
QB starter	user fabrication*) (EFAL 121	1 680 020 007)
Sleeve for supporting the drive shaft during torque adjustments KB starting motor	KDAL 5474 (EFAL 104	1 680 220 030)
QB starting motor	user fabrication*) (EFAL 122	1 680 220 019)
Thrust member for disassembly of the multi-plate clutch	user fabrication*) (EFAL 124	1 680 363 013)
Clamping sleeve for holding the armature in the three-jawed chuck KB starting motor	KDAL 5491 (EFAL 102	1 680 501 010)
QB starting motor	user fabrication*) (EFAL 120	1 680 224 003)
Claw-type extractor for ball bearing at bearing end-plate QB starting motor	commercially available	
Thrust member for pressing the ball bearing onto the bearing end-plate QB starting motor	user fabrication*) (EFAL 126	1 680 020 008)
Assembly wrench	KDAL 5483 (EFAL 127	1 687 950 520)
Clamping pin for KDAL 8479 KDAL 5471 KDAL 5003 EFAL 124	user fabrication*) (EFBO 9 Y 1x	1 683 523 005)
Silicone grease	Ft 2 v 1 250-g tin	5 700 080 125
Special lubricating grease	Ft 2 v 5 500-g tin	5 700 084 150
Special oil	Ol 1 v 13 0.1-l can 0.5-l can	5 701 042 511 5 701 042 605
Anti-corrosion oil	Ol 41 v 2 1.0-l can	5 701 351 610

*) Request drawings for user fabrication of the tools from KH/VSK.

( ) Old designations and part numbers, no longer available.

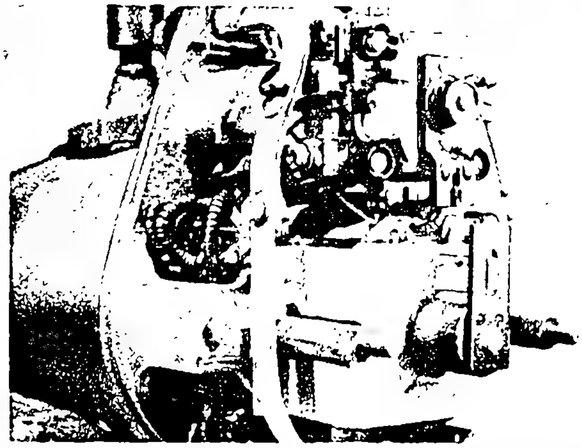
N7

2. Disassembly of the Starting Motor



1

Fasten the starting motor in the clamping support and remove the protective cap.



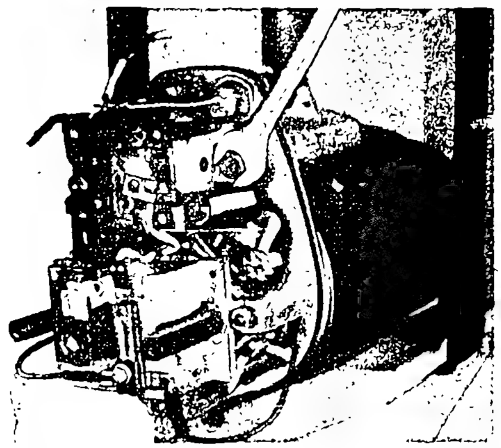
2

Unsolder the leads at Terminal 50.

With the QB starting motor, unsolder the ends of the holding and control windings (control relay) from the ground bar.

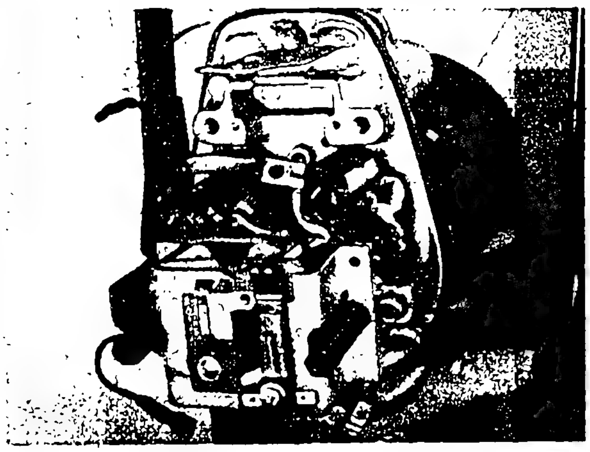
Remove the shunt winding from the auxiliary contact.

Unscrew the connections at the control relay and at Terminal 30.



3

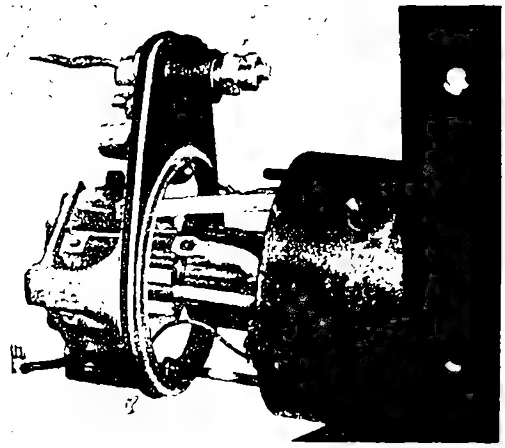
Remove the control relay and lift up the carbon brushes.



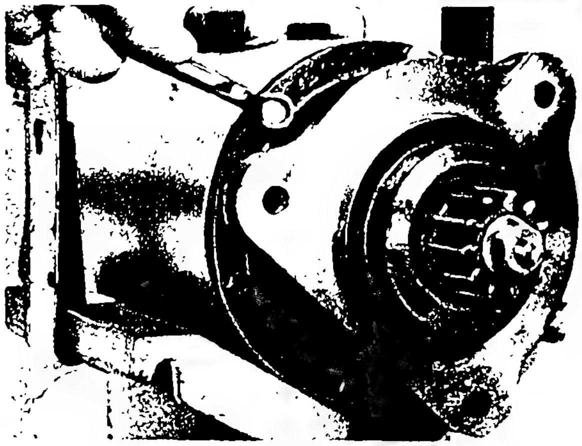
4

Unscrew the threaded pins for the starting-motor solenoid (or solenoid switch), and remove the solenoid (or solenoid switch). Be careful of backing plates.

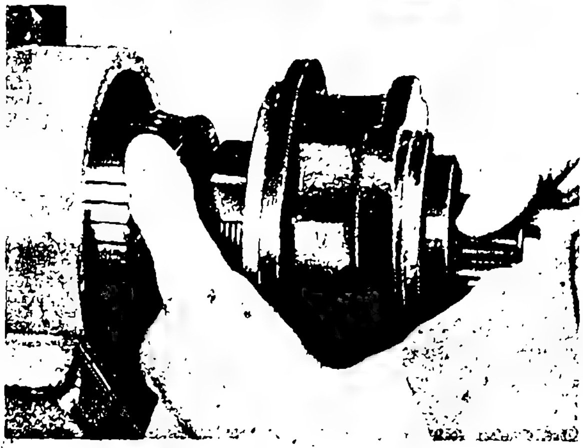
Release the commutator end shield and remove it carefully. Be careful of the shims on the armature shaft (commutator side). Do not damage the insulation on the projecting winding leads.


5

Mark the position of the drive-end bearing housing, and release the fastening bolts and fastening nuts.


6

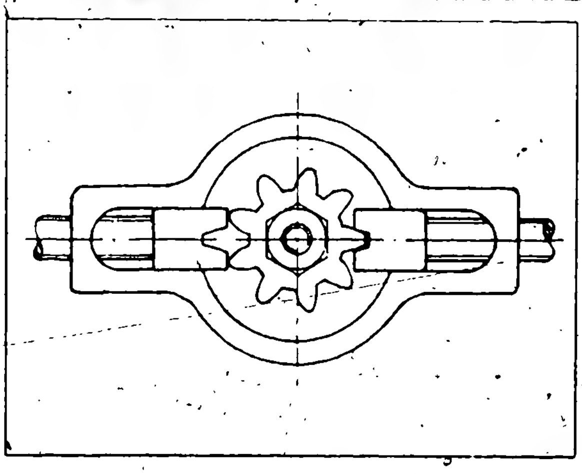
Pull the armature together with the drive-end bearing housing out of the stator frame.

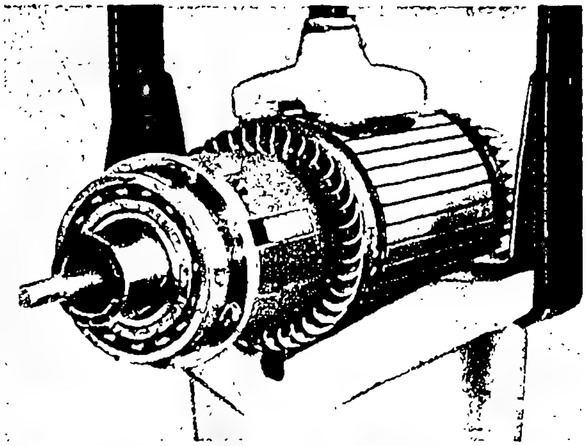

7

Place the armature together with the drive-end bearing housing in the clamping support and unscrew the 4 threaded pins from the drive-end bearing housing. Clamp the armature.

Bend off the locking washer and release the pinion mounting nut. Use the assembly wrench to do this.

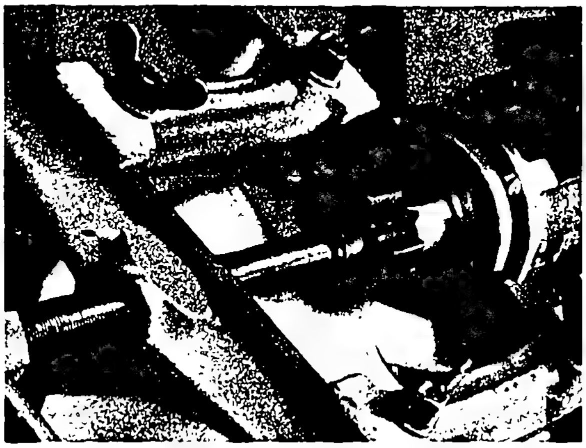
With a pinion that has an odd number of teeth, apply the assembly wrench as shown in Fig. 8.


8



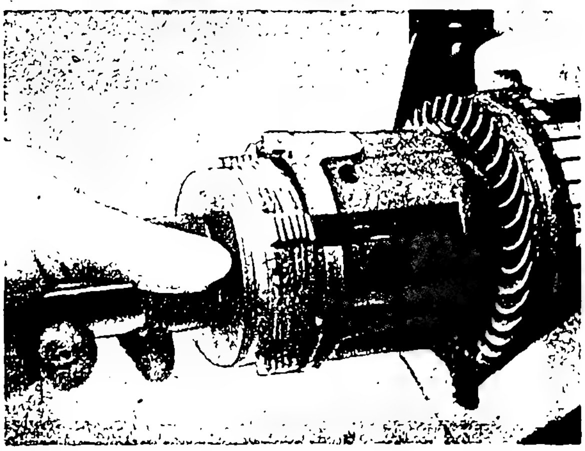
9

Withdraw the solenoid switch in the direction of the commutator.



10

With the QB starting motor, pull the ball bearing off the bearing end-plate using a commercially-available claw-type extractor. For this purpose, reinsert the pinion and use it as a centering thrust member. With the KB starting motor, release the intermediate bearing from the clutch housing and remove it.



11

Remove the complete drive spindle.

3. Cleaning the Parts

Wash the parts in cleaning gasoline or trichloroethylene and blow them dry with compressed air (maximum pressure 4 atm $\triangleq$ 4 bar overpressure). Wash the armature, windings, and bearing only briefly and dry them off immediately.

Caution:
Dry the cleaned parts thoroughly because otherwise gases can form later in the sealed starting motor which can result in an explosion-like detonation.

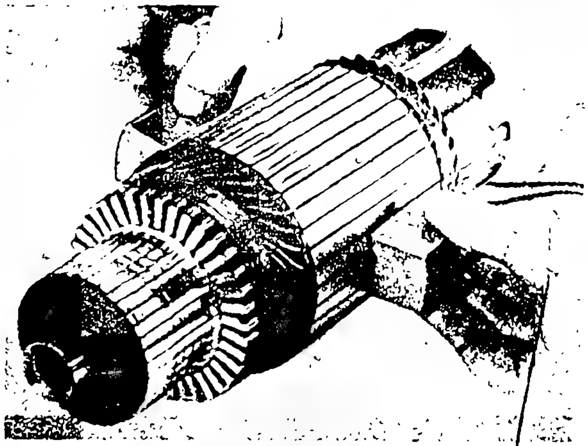
N10

4. Checking and Repairing the Parts

4.1 Armature

Make a check for an interturn short-circuit using the tester and the test probe, and make a check for a short-circuit to ground using the test and transformer panel.

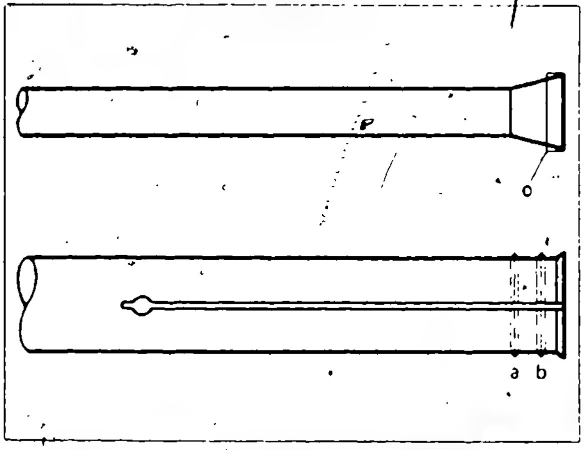
Test voltage: 80 V AC



12

Replacing the Bearings in the Armature

Before the bearings are removed, the two annular projections "a" and "b" on the spring collet must be ground off, and the stop "c" on the clamping taper at the end of the puller must be ground to a bevel in order to achieve sufficient expansion of the collet.

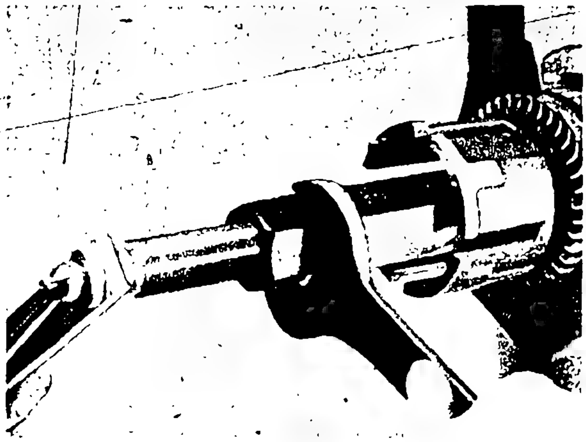


13

Bushings must always be replaced with needle-roller bearings.

Using the puller and the spring collet, withdraw the bushings individually and one after the other because of the thinwalled spacer.

Replace the **needle-roller bearing** only if the bearing on the engagement rod displays a poor contact reflection (impressions).

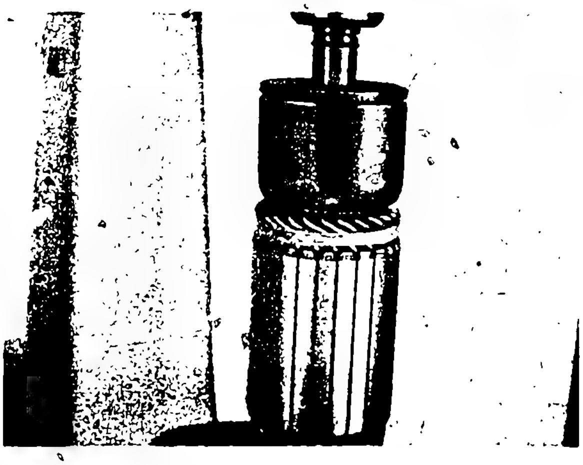


14

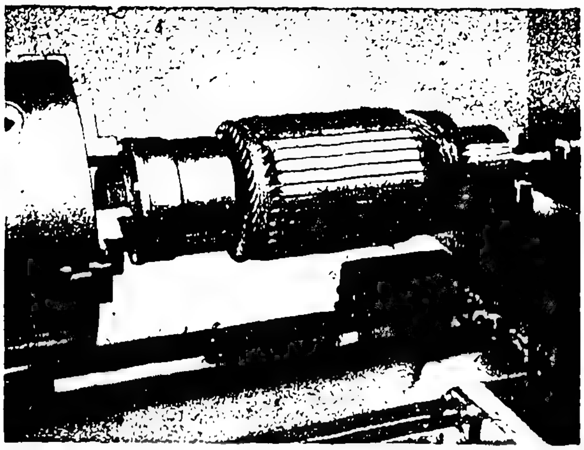
Before the needle-roller bearing is pressed in, the needle bushings should be greased on the inside with special lubricating grease Ft 2 v 5.

Set the press-in mandrel in the arbor press using the clamping pin, and press the needle-roller bearing into the armature so that the designation of the needle-roller bearing is visible from the outside.

With armatures which originally had bushings, spacer sleeve 2 000 224 020 must be installed before the needle-roller bearing is pressed in.



15



16

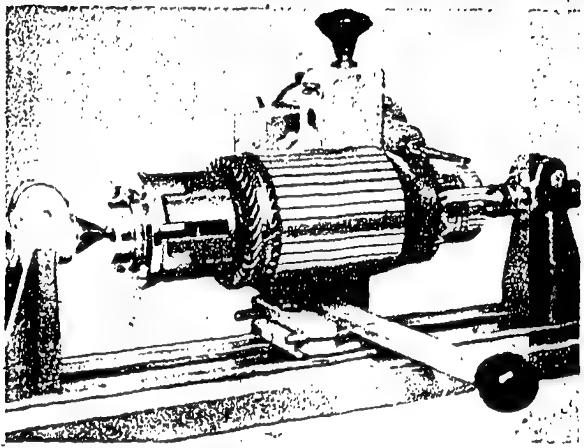
4.2 Commutator

In order to turn down the commutator, the bearing end-plate or the intermediate bearing at the clutch housing must be bolted to the armature.

Clamp the armature in the three-jawed chuck using the clamping sleeve.

Commutator – minimum diameter:
KB starting motor: 47.5 mm,
QB starting motor: 59.0 mm.

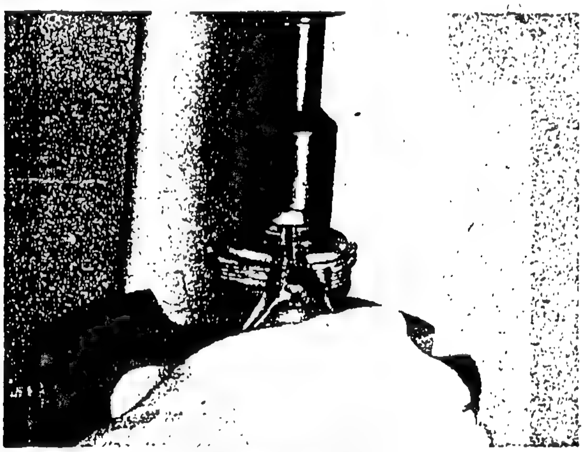
Runout: max. 0.03 mm.



17

Using the thrust member, place the armature on the undercutting saw (commutator saw), and saw down the commutator insulation.

Then fine-turn the commutator and check it again for short-circuits to ground as well as for interturn short-circuits.



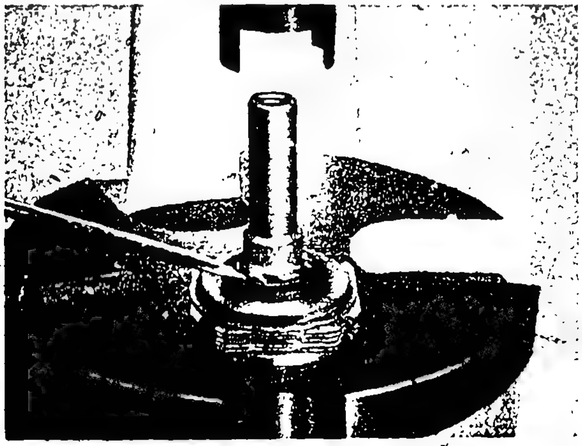
18

4.3 Drive Spindle with Multi-plate Clutch

Press the stop ring down with the locally-made thrust member and press the retainer out of the slot with the circlip pliers. Remove all parts and check them carefully.

Renew the clutch plates.

Before reassembly, grease all clutch elements lightly according to the Lubrication Specifications. (Section 9).



19

KB Starting Motor

Starting with FD 224 (Apr. 72), this spindle was modified. As a complete unit, however, this spindle is interchangeable with the previous drive spindle.

The sets of parts required to repair the new drive spindle are given in Service Parts List VDT-EVE 513 9 (Jan. 74) and on microfiche EE . .

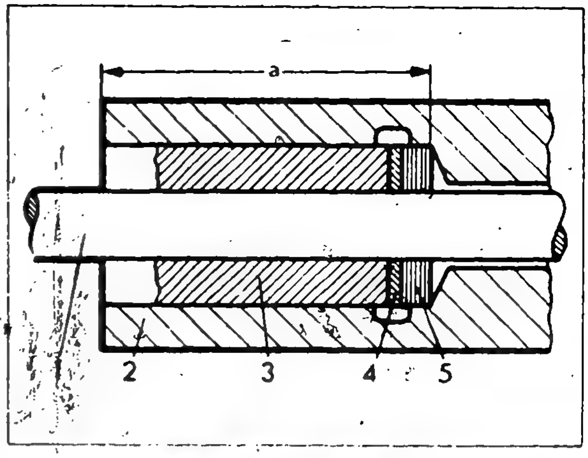
Parts from the old and the new design should not be interchanged.

If the retainer is not positioned firmly in place after the stop ring has been pressed down during assembly of the drive spindle, the retainer must be pressed into the stop ring with a small screwdriver.

N12

With starters fitted with an extended drive spindle (shaft length about 80 mm), the depth of the hole, dimension "a", 44 + 0.6 mm, must be checked. If the hole is deeper, washer 3 100 100 000 must be installed between the rubber bushing and the pinion shaft.

1 = engagement rod
2 = drive spindle
3 = pinion shaft
4 = washer 3 100 100 000
5 = rubber bushing

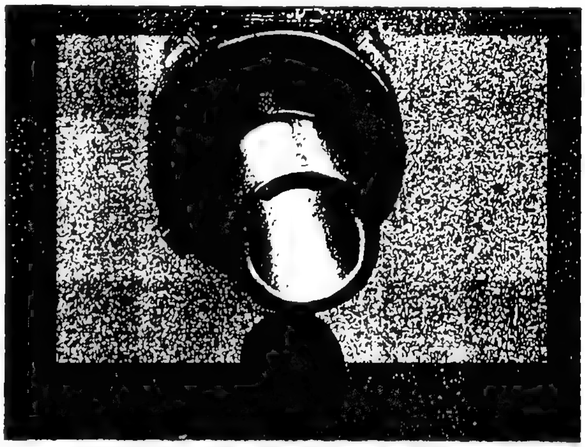


20

QB Starting Motor

See Service Parts List VDT-EVE 513/24 (Aug. 71) or microfiche EE .. for the sequence of the clutch elements. Install the spring washer during assembly so that the curvature is against the clutch nut. With oil- and water-proof starting motors, a seal ring is installed instead of the rubber bushing.

Starting with FD 525 (May 75), a modified drive spindle has been installed. This is described in Technical Bulletin VDT-I-001/107 B dated July 1975.


21

KB and QB Starting Motors

Caution: Be sure that the retainer is properly seated in the slot in the drive spindle and stop ring. Use only the retainer and stop ring specified in the newest service parts list or microfiche.

End Play of the Clutch Nut

KB starting motors with new drive spindle design (starting with FD 224):	0.9 . . . 1.8 mm
in all other starting motors:	0.4 . . . 1.2 mm.

Introduce the assembled drive spindle into the armature, and bolt the bearing end-plate or intermediate bearing onto the clutch housing, applying a torque of 7 . . . 8 N·m (0.7 . . . 0.8 kgf·m).

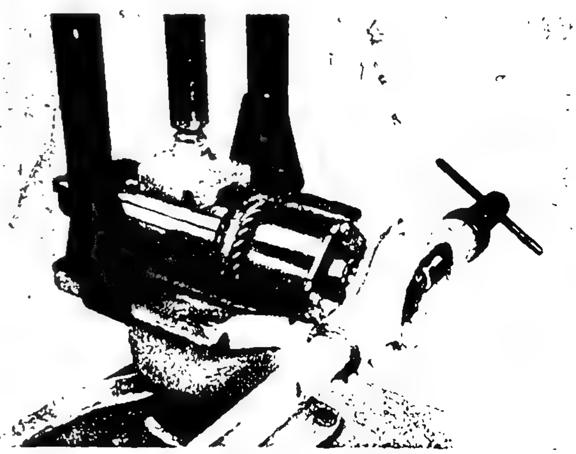
Overload protection

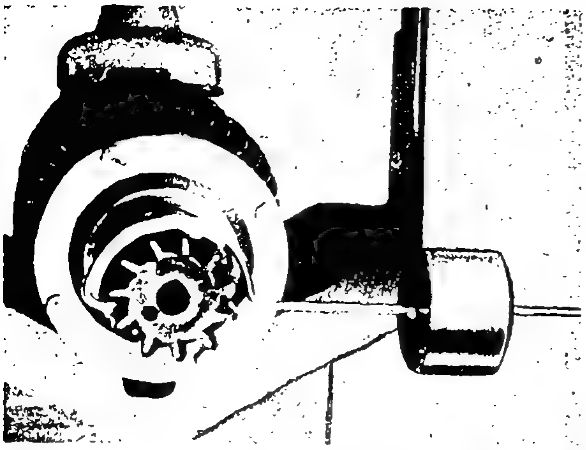
Introduce the sleeve over the drive spindle into the bearing end-plate (intermediate bearing). Install the pinion in the drive spindle and adjust the response torque of the overload protection with the torque-meter.

KB starting motor:	160 . . . 200 N·m (16 . . . 20 kgf·m)
QB starting motor:	180 . . . 220 N·m (18 . . . 22 kgf·m)
starting with FD 525:	200 . . . 240 N·m (20 . . . 24 kgf·m).

The response torque can be corrected by adding or removing shims.

As a basic rule, the spring lockwasher at the clutch must be renewed after every disassembly of the starting motor (and also after readjustments).


22



23

Overrunning Torque
Using the torquemeter, check the overrunning torque of the multi-plate clutch:

KB starting motor:	0.2 . . . 0.4 N·m (2 . . . 4 kgf·cm)
QB starting motor:	0.3 . . . 0.5 N·m (3 . . . 5 kgf·cm).

4.4 Stator Frame (Fig. 24)

Check for a **short-circuit to ground** with the test and transformer panel. Check each winding to ground.

Test voltage: 80 V AC.

Check the excitation winding for **open-circuit.**

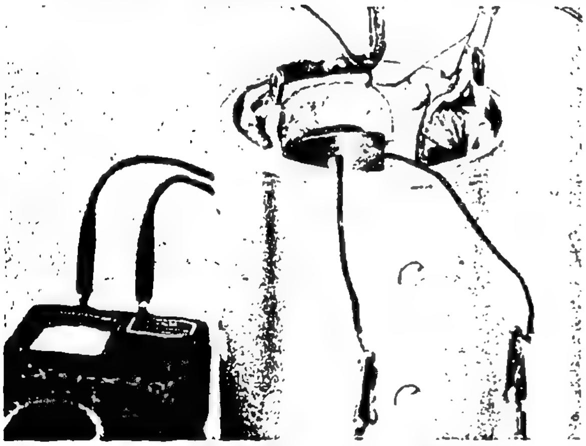
Test voltage: 6 V DC.

24

Measure the **resistance values** with the ohmmeter (Fig. 25).

KB starting motor	
shunt winding (red/blue):	0.8 Ω + 10 %
QB starting motor	
shunt winding (blue/blue)	1.28 Ω*) + 10 %
auxiliary winding (white/red)	0.7 Ω*) + 10 %.

Renewing the Excitation Windings
(also see VDT-WJA 021/3 B)



25

Disassembly (Fig. 26)

Mark the position of the pole shoes. Place the stator frame in the clamping support and release the pole shoe bolts.
Remove the windings together with the pole shoes.

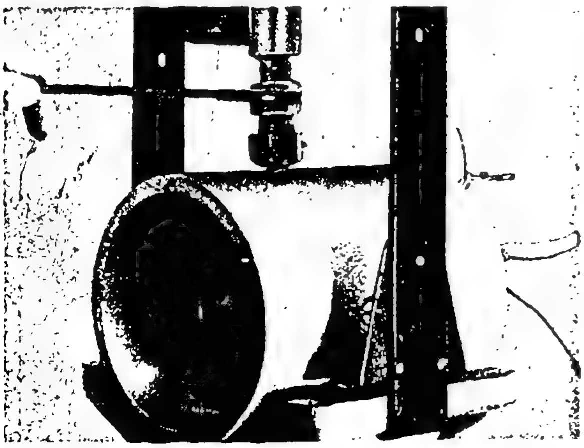
KB starting motors have been fitted with a modified stator frame and modified pole shoes starting with FD 132 (Dec. 71).

Stator frame inner diameter,
through Nov. 71: 110 + 0.1 mm,
starting in Dec. 71: 109.2 + 0.1 mm.

Pole shoe height,
through Nov. 71: 12.8 ± 0.1 mm,
starting in Dec. 71: 12.4 ± 0.1 mm.

The new (modified) stator frames can be recognized by the pilot machined out on the drive side for the drive-end bearing housing.

Caution:
Renew the stator frame together with the pole shoes, otherwise the armature will either graze against the pole shoes or the air gap will be excessive.



26

*) total resistance for two windings

W-001/101

Assembly

Heat the excitation windings slightly before installing them, then fit them together with the pole shoes into the stator frame (observe marking), and bolt them loosely in place

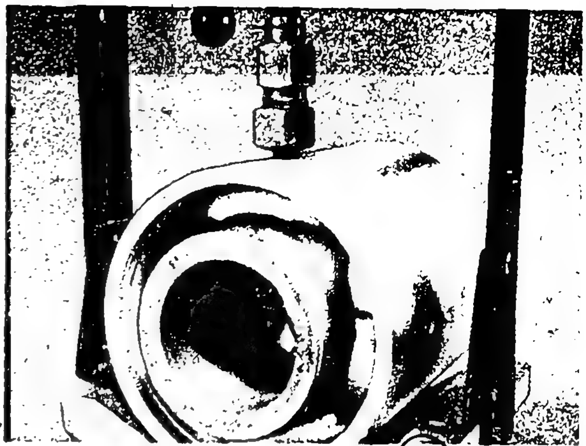
Press in the pole-shoe alignment mandrel.

KB starting motor: diameter $84.0 \begin{smallmatrix} -0.01 \\ -0.06 \end{smallmatrix}$ mm.

QB starting motor: diameter $101.0 \begin{smallmatrix} -0.01 \\ -0.06 \end{smallmatrix}$ mm.

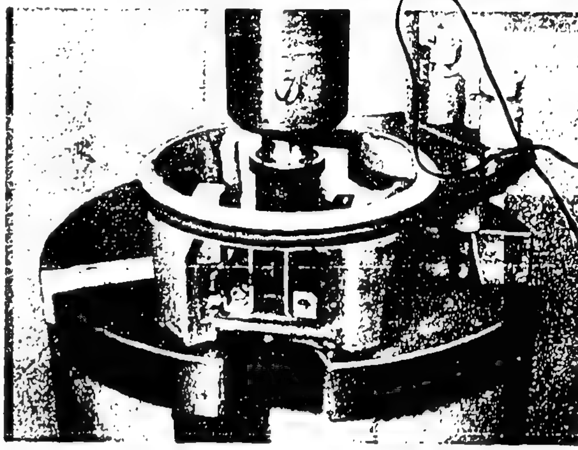
Fasten the stator frame in the clamping support. Tighten the pole shoe bolts and press out the pole-shoe alignment mandrel on the arbor press.

Check the installed windings for short-circuit to ground and for open-circuit.


27

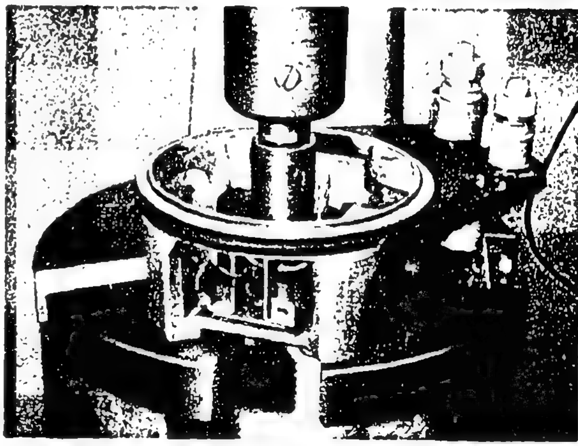
4.5 Commutator End Shield

Press out the bushing using the press-out and press-in mandrel.


28

Press the bushing in with the other end of the mandrel.

A suitable support must be used with the QB starting motor.


29

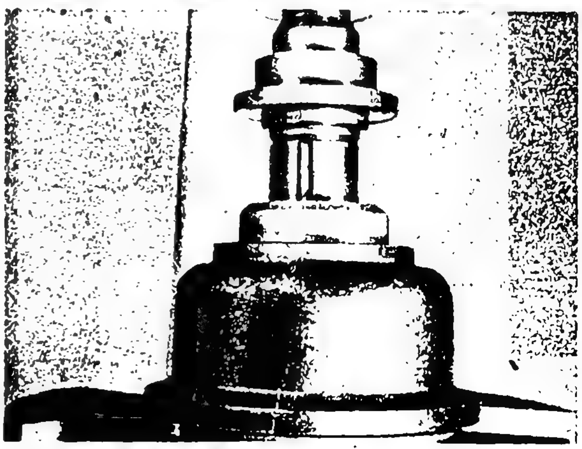
4.6 Drive-end Bearing Housing

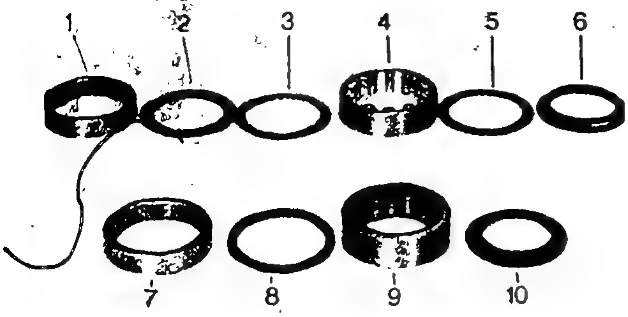
Press out the roller bearing (together with the bushing in the KB starting motor) using the press-out and press-in tool.

The gripping edges of the two press-out tool jaws must be applied between the radial seal and the roller bearing. Remove the radial seal.

Check the parts pressed out (roller bearing, radial seal, and bushing) for any damage.

If a part is found to be damaged, all parts in the drive-end bearing housing must be renewed.

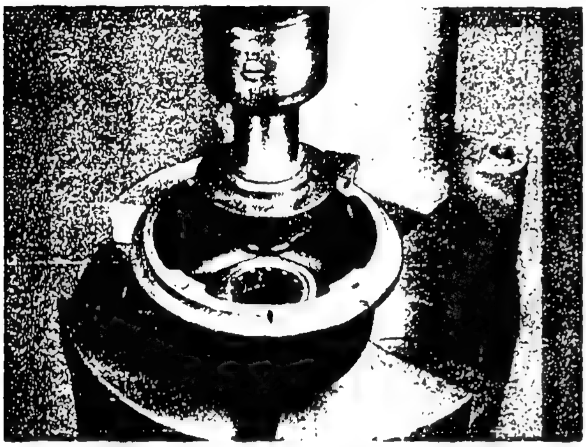

30



31

Fig. 31 shows the old and the new design in the KB starting motor.

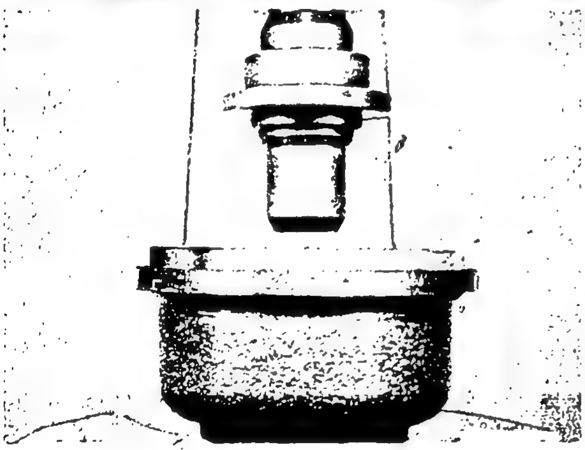
Old design	New design
1 = bushing	7 = bushing
2 = felt disc	8 = felt disc
3 = washer	9 = roller bearing
4 = roller bearing	10 = radial seal
5 = washer	
6 = radial seal	



32

Press the bearing in with the press-out and press-in tool. The felt discs in the KB starting motor must be impregnated with Ol 1 v 13 before they are installed.

With the old design KB starting motor be sure that the open side of the roller bearing is toward the radial seal.



33

In order to press the bushing in, turn the press-in tool over.

4.7 Control Relay

Replace a burned or damaged relay. For relays with winding lead to ground, check for a firm ground connection.

With a vibration-proof starting motor, the ground connection must be secured with an adhesive material.

N16

W-001/401

Control relay switched off

Dimension "A" and "B"
0 331 100 . . : 3.2 ± 0.2 mm
0 331 101 . . : at least 2.0 mm

Locking lever and release lever in rest position, locking lever slightly pressed in.

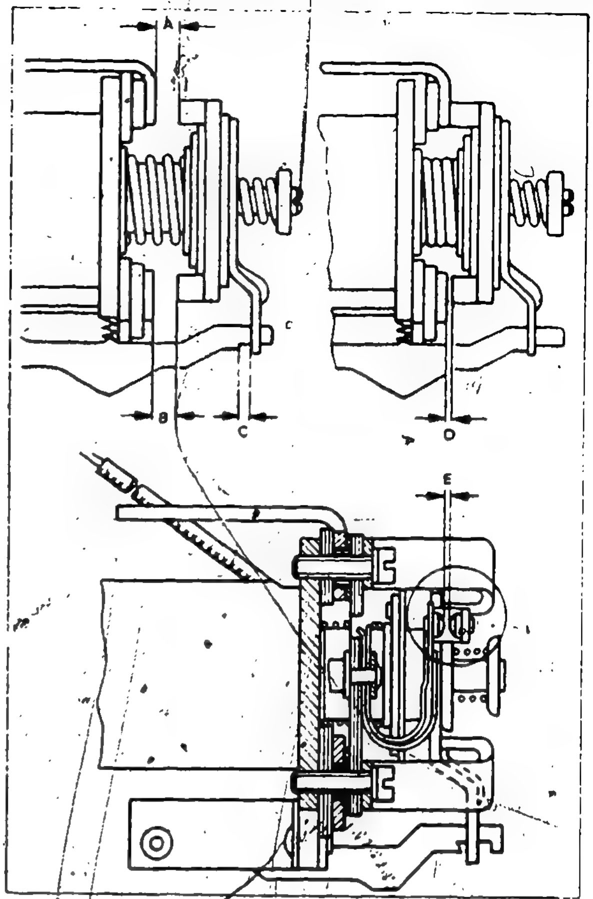
Dimension "C"
0 331 100 . . : ---
0 331 101 . . : at least 0.5 mm

Armature drawn in, release lever in locking position

Dimension "D"
0 331 100 . . : 1.0 ± 0.2 mm
0 331 101 . . : 1.0 ± 0.2 mm

Auxiliary contacts, control relay switched off

Dimension "E"
0 331 100 . . : 1.5 ± 0.2 mm
0 331 101 . . : at least 0.8 mm



34

5. Assembly of the Starting Motor

Before and during assembly, lubricate parts according to Lubrication Specifications (Section 9).

Fasten the armature in the clamping support. Install the drive spindle together with the complete clutch in the armature.

KB Starting Motor
Bolt the intermediate bearing in place. Use new hexagon bolts (Quality Class 10.9, previously 10 K) and new spring lock-washers.

Tightening torque: 7 . . . 8 N·m (0.7 . . . 0.8 kgf·m).

Slide anti-friction disc on the intermediate bearing.

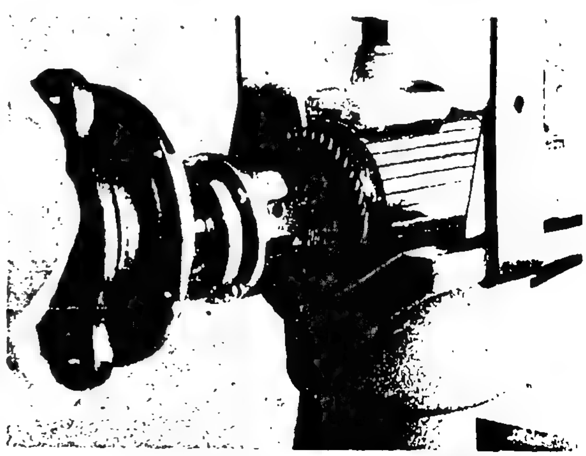
QB Starting Motor
Bolt the bearing end-plate in place. Use new hexagon bolts (Quality Class 10.9, previously 10 K) and new locking washers.

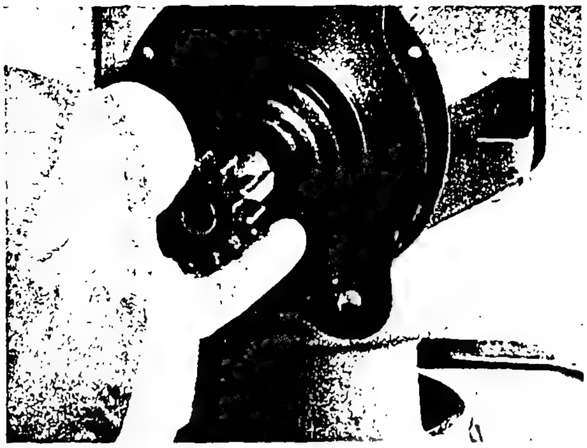
Tightening torque: 7 . . . 8 N·m (0.7 . . . 0.8 kgf·m).

Tab washers must be bent around the bolt heads and must make good contact with two of the bolt head surfaces.

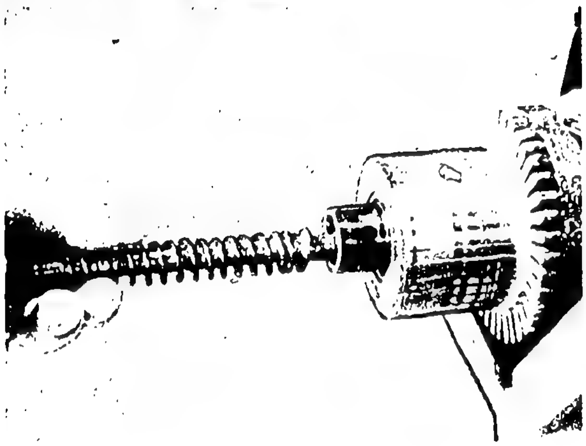
Press the ball bearing onto the bearing end-plate using the thrust member.

KB and QB Starting Motors
Slide the drive-end bearing housing onto the drive spindle.

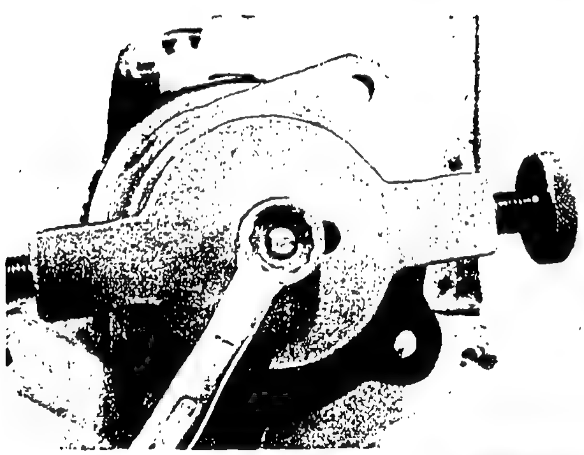

35


36

Press the parallel key into the pinion shaft and slide the pinion into the drive spindle.

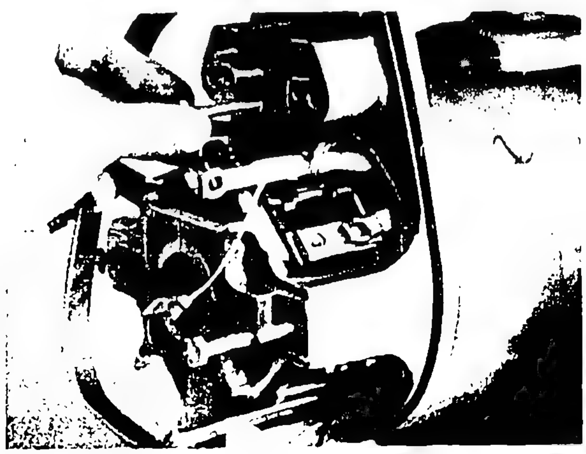

37

Install the engagement rod in the armature from the commutator end.


38

Place the drive pinion locking washer on the shaft and tighten the nut with a torque of 22 . . . 31 N·m (2.2 . . . 3.1 kgf·m) for the KB starting motor and with a torque of 20 . . . 30 N·m (2 . . . 3 kgf·m) for the QB starting motor so that when the tab on the locking washer is bent it is brought into contact with one of the 6 surfaces on the bolt head.

Caution:
The locking washer must not extend into the root circle of the pinion. Renew the "Uni-Stop" nut using a new nut of this type. Do not bend the safety tab over by hammering it, but instead use a pair of pliers. Use the assembly wrench (KDAL 5483) on the pinion when tightening the nut, in order to avoid shearing off the pinion locating nose.


39

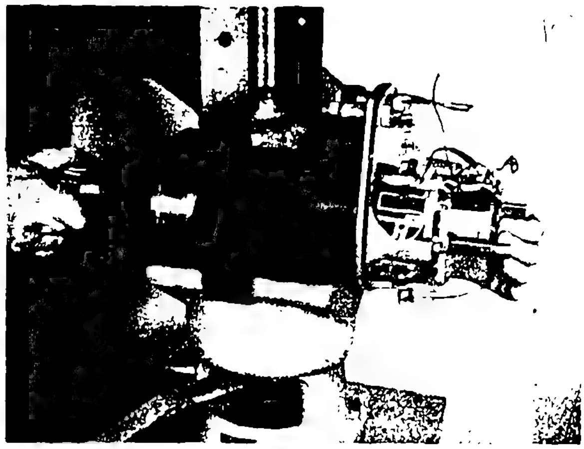
Fasten the stator frame in the clamping support. Place the commutator end shield on the stator frame, being careful not to damage the winding leads. Slide the armature with the drive-end bearing housing into the starter frame and bolt the starting motor together.

Tightening torque: 7 . . . 8 N·m (0.7 . . . 0.8 kgf·m).

Armature End Play

KB starting motor:	0.2 . . . 0.6 mm
QB starting motor:	0.2 . . . 0.3 mm

Compensate for axial clearance only on the commutator side. Without the carbon brushes installed, check the armature for ease of rotation.

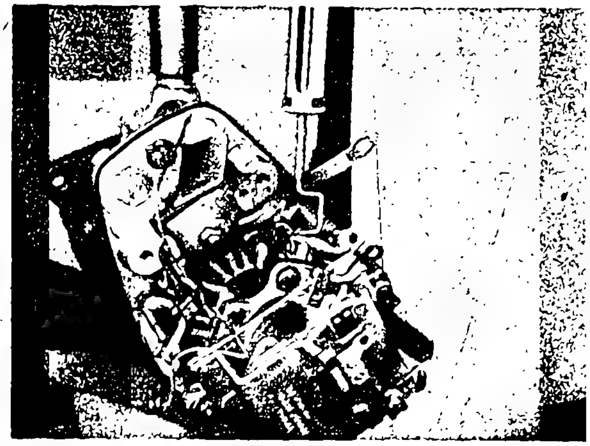


40

Install the carbon brushes.
Route the electric wiring so that the carbon brushes can move easily in the brush holders.

Check the brush pressure with a spring balance.

KB starting motor	13 + 1 N (1.3 + 0.1 kgf)
QB starting motor	21 + 1 N (2.1 + 0.1 kgf)



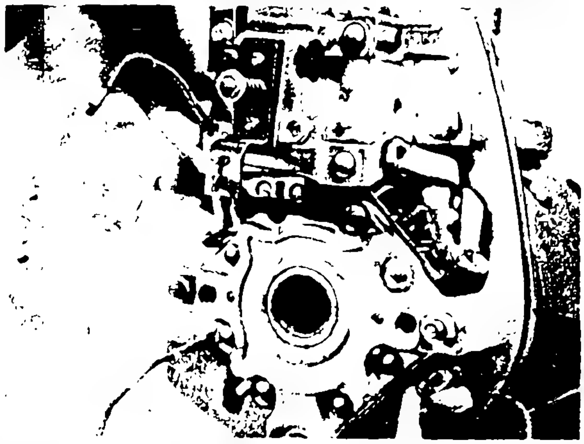
41

Control Relay

If this relay is defective, be absolutely sure that it is replaced only by the type of relay given in the service parts list or on the microfiche.

When installing a control relay 0 331 101 . . in a KB starting motor with long excitation winding leads, shorten these leads by about 7 mm by bending them in a loop.

If an excitation winding with short winding leads is to be installed in a starting motor fitted with the older control relay, 0 331 100 . ., the control relay must be replaced by a new design relay, 0 331 101 . . .



42

Solenoid Switch and Starting-motor Solenoid

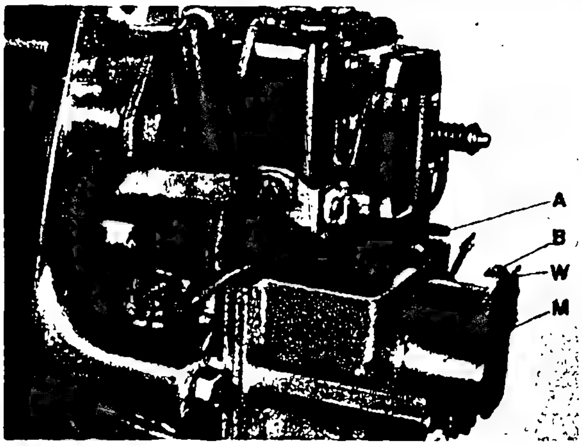
No parts can be replaced in the solenoid switch (in the KB starting motor) or in the starting-motor solenoid (in the QB starting motor).

In the solenoid switch the contacts at the shunt field change-over switch should be cleaned with a contact file.

Replace a defective solenoid switch or starting-motor solenoid.

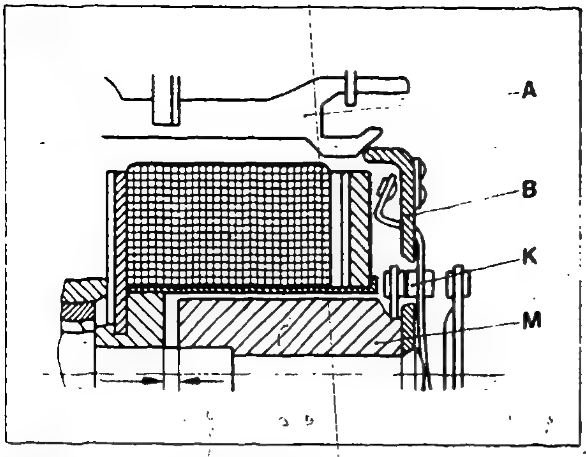
Only solenoid switches with a shunt field change-over switch should be installed in KB starting motors.

Fasten the solenoid switch or starting-motor solenoid in place with threaded pins.

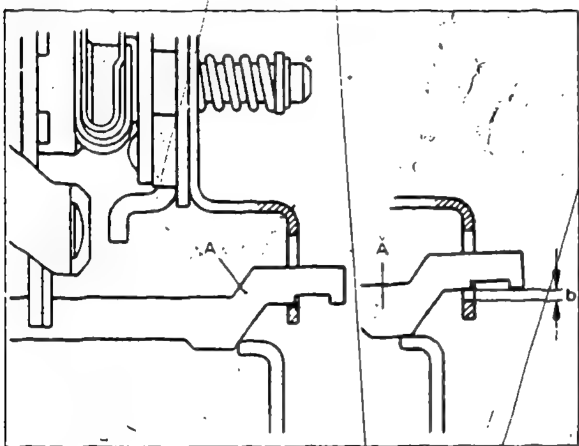


43

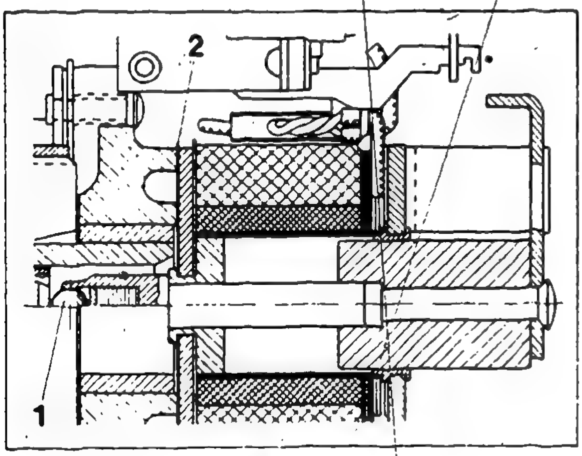
N19



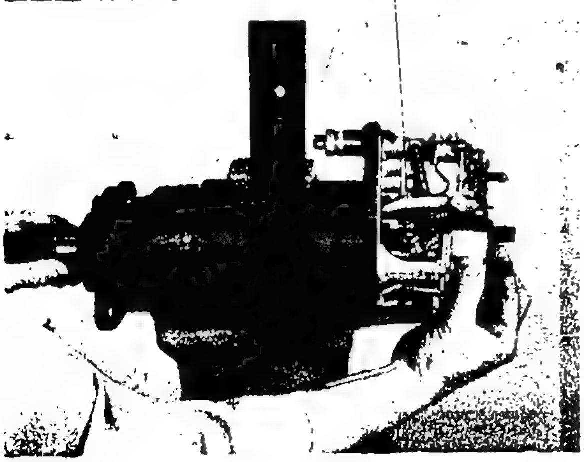
44



45



46


47

Adjustments

KB Starting Motor

When the tripping lever "B" at the solenoid switch is in the release position (touching release lever "A"), the remaining distance which the solenoid plunger can travel before it is brought up against its seat must be 1 . . . 2 mm. If necessary, bend the tripping lever ("W", Fig. 43) and set this distance. Be careful of the riveted joint when bending the lever.

The make contact in the shunt field change-over switch "K" must close 0.6 . . . 1.8 mm before the end of solenoid plunger travel, i. e. the shunt field is connected to ground or minus before the end of plunger travel.

Checking the reserve for wear and tear

When the release lever "A" (trigger) and the locking leg of the control relay are in the end position (main current), dimension "b" between the release lever and the locking leg must be 2.0 . . . 3.0 mm.

QB Starting Motor

It must be possible to press the pinion back resiliently by means of the rubber cushioning in the thrust member of the starting-motor solenoid when the pinion is in the rest position. When the engagement rod is in the rest position, it must rest against the ball in the starting motor solenoid.

Check the return forces with the return spring installed.

Initial pressure:	35 . . . 45 N (3.5 . . . 4.5 kgf)
final pressure:	60 . . . 70 N (6.0 . . . 7.0 kgf)

1 = ball
2 = backing plate

Axial Clearance of Drive Spindle

Slide the starting motor armature into the working position over the solenoid switch or starting-motor solenoid. The pinion can now be drawn forward by the amount of the drive spindle end play.

KB starting motor:	at least 0.3 mm
QB starting motor:	at least 0.2 mm

If there is not enough end play, increase it with a backing plate (Fig. 46, No. 2) at the solenoid switch or starting-motor solenoid.

N20

6. Testing

See Test Instructions VDT-WPE 510/2 B and Test Specification Sheet VDT-WPE 510/203 B.

Check that all current-carrying parts have sufficient spacing and do not rub against each other. Be sure that the ends of the leads are routed neatly.
See VDT-WJE 510/4 B for details on the oil- and waterproof designs.

7. Electrical Connections and Wiring Diagrams

1 = excitation winding
2 = shunt winding
3 = auxiliary winding
4 = control relay
5 = solenoid switch
6 = shunt field change-over switch
H = holding winding
E = pull-in winding

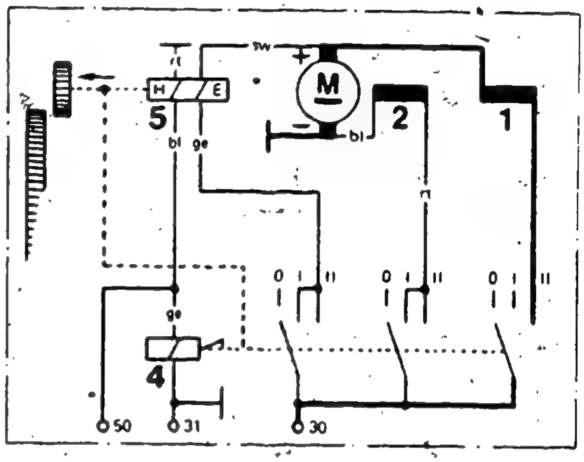
bl = blue
ge = yellow
rt = red
sw = black
ws = white

7.1

KB starting motors **without** shunt field change-over switch and with ground return. Terminal 31 not insulated.

Wiring diagram before installation of a solenoid switch with shunt field change-over switch.

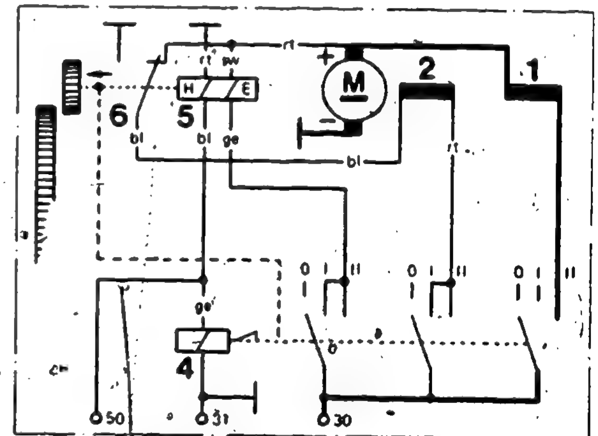
When voltage to terminal 50 is switched off, the auxiliary contact separates the current branches: contact bridge to shunt winding, and contact bridge to pull-in winding from each other. As a result, build-up of a magnetic field through the generator winding in the pull-in winding is avoided (Fig. 48).



48

7.2 KB Starting Motors with Shunt Field Change-over Switch

Lengthen the shunt winding leads to about 185 mm with extension lead 2 004 438 001. Slide an insulating tube over the soldered joint.



49

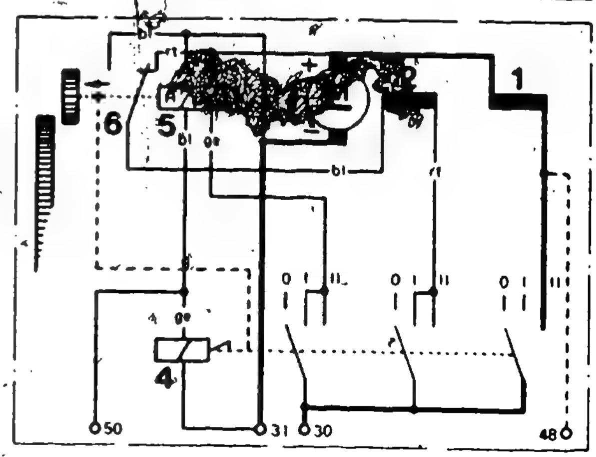
7.2.1. With Ground Return (Terminal 31 not insulated)
Solenoid switch 0 331 450 001 must be used with starting motors employing ground return.

I = shunt winding in series with the armature (as auxiliary excitation winding)
II = shunt winding in parallel with the armature.

7.2.2 With Insulated Return Circuit (Fig. 50)
Solenoid switch 0 331 450 002 must be used with starting motors fitted with an insulated return circuit.

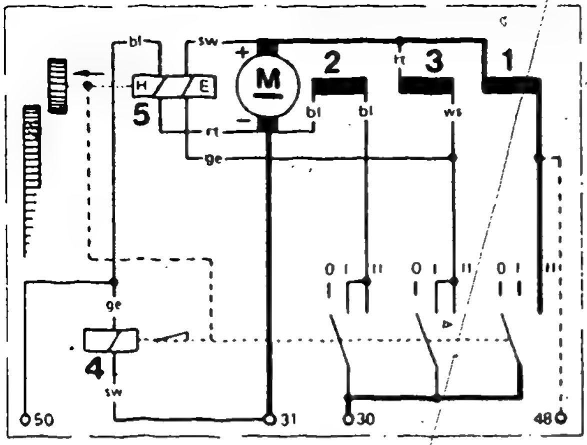
Terminal 48 for operation with start-repeating relay.

I = shunt winding in series with the armature (as auxiliary excitation winding)
II = shunt winding in parallel with the armature.

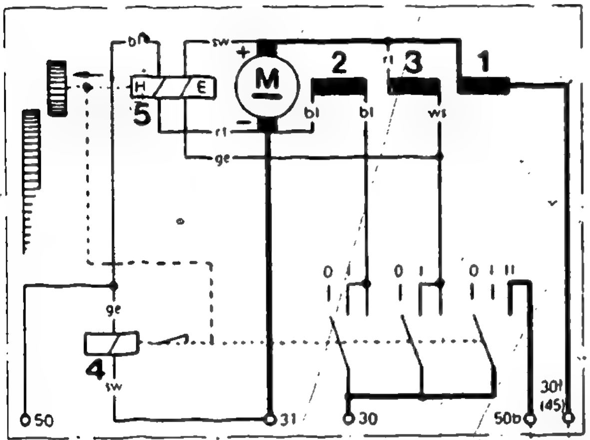


50

N 21



51



52

7.3 QB Starting Motors

For operating with start-repeating relay, Terminal 48 (Fig. 51):

For parallel operation (Terminals 30 f and 50 b) of 2 starting motors on one flywheel ring gear (Fig. 52) The main current for both starting motors is switched through a double-starting relay when both starting-motor pinions have meshed.

In order to test a parallel-operation starting motor, place a bridge from Terminal 30 (45) to Terminal 50 b (50 d) – main current.

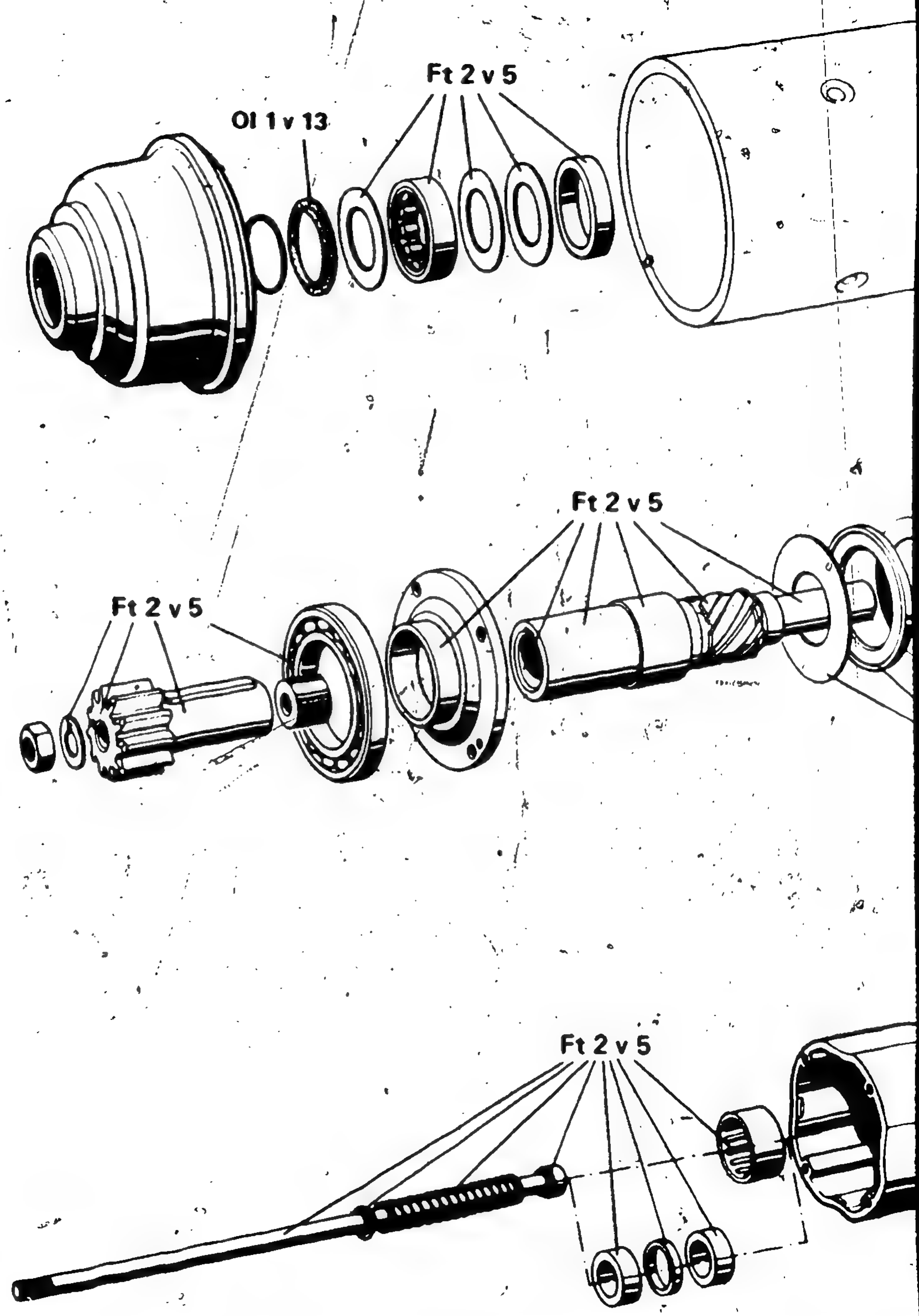
8. Technical Data

	KB Starting Motor	QB Starting Motor
Minimum commutator diameter	47.5 mm	59.0 mm
Brush pressure	13 + 1 N	21 + 1 N
End play of armature	0.2 . . . 0.6 mm	0.2 . . . 0.3 mm
End play of drive spindle	at least 0.3 mm	at least 0.2 mm
Return force of helical spring on the engagement rod		
initial pressure	35 . . . 45 N	35 . . . 45 N
final pressure	60 . . . 70 N	60 . . . 70 N
Tightening Torques		
Hexagon nut at pinion	22 . . . 31 N·m	20 . . . 30 N·m
Bolts holding the intermediate bearing on the clutch housing or on the bearing end-plate	7 . . . 8 N·m	7 . . . 8 N·m
Concentricity		
of commutator	max. 0.03 mm	max. 0.03 mm
of laminated core	max. 0.05 mm	max. 0.05 mm
Multi-plate Clutch		
Overload protection	160 . . . 200 N·m	180 . . . 220 N m (200 . . . 240 N m)
Overrunning torque	0.2 . . . 0.4 N·m	0.3 . . . 0.5 N m

Other Technical Data

Microfiche	VDT-EE . .
Service parts list for KB starting motor	VDT-EVE 513/19
Service parts list for QB starting motor	VDT-EVE 513/24
Replacement of excitation winding	VDT-WJA 021/3 B
Test instructions for starting motors	VDT-WPE 510/2 B
Test specifications	VDT-WPE 510/203 B
Test instructions for solenoid switch	VDT-WPE 712/3
Test specifications	VDT-WPE 712/3-1
Oil- and water-proof designs	VDT-WJE 510/4 B

K12



N 23

K12 Seite 19

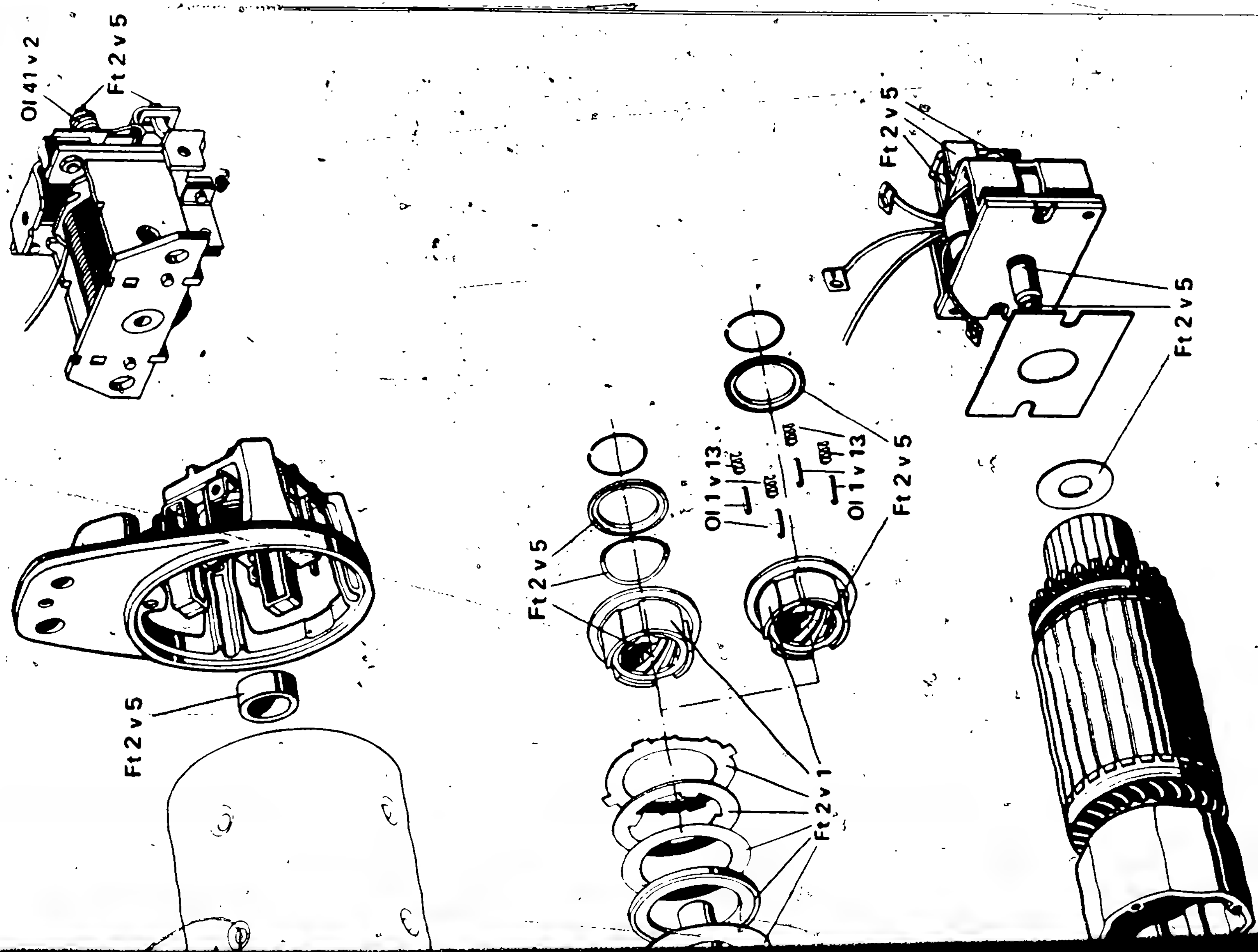
W - 001/101

N 24

Seite 20

9. Lubrication Specifications

(Drawing can not be used for assembly.)



N24

New Product

VDT-I-001/2 En

2.1982

SLIDING-GEAR STARTING MOTOR

0 001 420 .. KE 24 V 7.5 kW
0 001 421 .. KE 12 V 5.5 kW

Since the start of 1981, Bosch has been delivering a new sliding-gear starting motor, the Type KE.

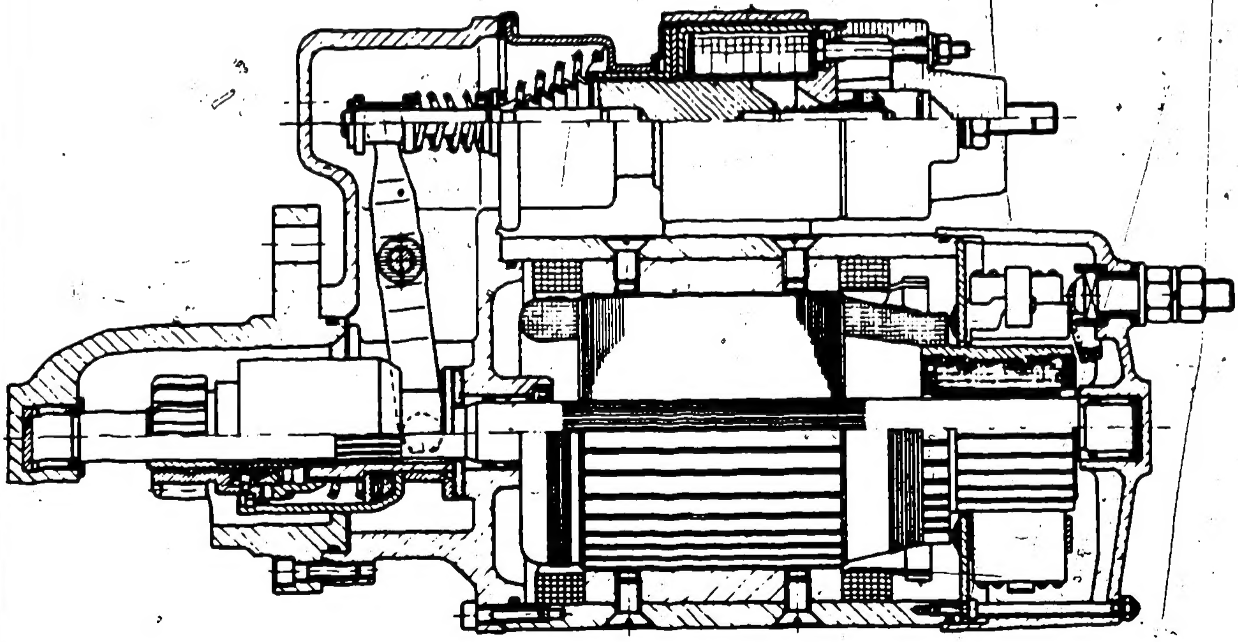
This starting motor is an electrically driven, single-stage sliding-gear starting motor with mechanical pinion rotation and an insulated return line.

It is protected against heat, oil and water.

The external features of this starting motor are its "cradle"-mounted solenoid switch which actuates the overrunning-clutch drive (Positork) through a fork lever. The flange can be rotated to suit the engine in question and the end shield is of the open type.

The first customer for the 24 V version is Caterpillar Co.

Repair instructions and test instructions are in preparation as are the after-sales service tools.



N 25

BOSCH

N25

0 001 510 .. – QB 24 V 9 PS –
Introduction of various improvements in starting motors

VDT-BME 513/33 B AL 00
< VDT-I-001/101 >
Edition 11.1974
Translation of German edition of 17.10.1974

In order to meet today's more stringent requirements, improvements were necessary in the following QB starting motors:

0 001 510 008
009
014
017
018

Individual details are given below:

1. Fastening screw – drive end shield

In individual cases the fastening screws in the drive end shield had begun to work loose, and this was remedied by a changeover from fillister head screws to hexagon screws 2 911 072 199 (quality 10.9) at the beginning of 1973.

As from September 1974 (FD 429) there has been a changeover to the 2 mm longer hexagon screws 2 911 062 201 (quality 8.8) and the threaded holes in the stator frame have been made 6 mm deeper.

In case of repair the old fillister head screws must be replaced by hexagon screws.

The screws should be tightened with 7 – 8 Nm (0.7 – 0.8 kgf·m) of torque.

2. Improved auxiliary excitation winding

For the vibration-proof starting motors listed above the auxiliary excitation winding 2 004 106 035 was introduced in the middle of 1972. The insulating sleeves on the terminal ends have been improved and the connection leads between the coils of the auxiliary winding are fastened to the drive end of the main winding with hemp string. (Fig. 1)

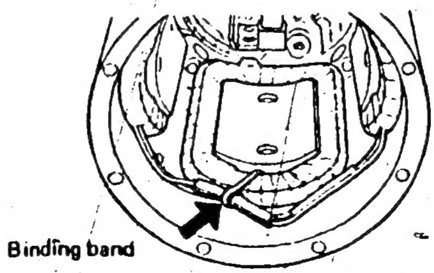


Fig. 1

N 26

3. Supporting the connecting bars of the main windings

In individual cases the connecting bars of the main winding have broken off directly behind the fastening screws on the relay. In order to avoid this, the connecting bars have been fastened with straps and a rubber hose pulled across the connecting bars in starting motors 0 001 510 008 and .. 017 as well.(Fig. 2) The straps are mounted with the fastening screws for the relay.
In addition to this the connection leads to the auxiliary and shunt windings must be firmly fixed in place as detailed in Fig. 2.

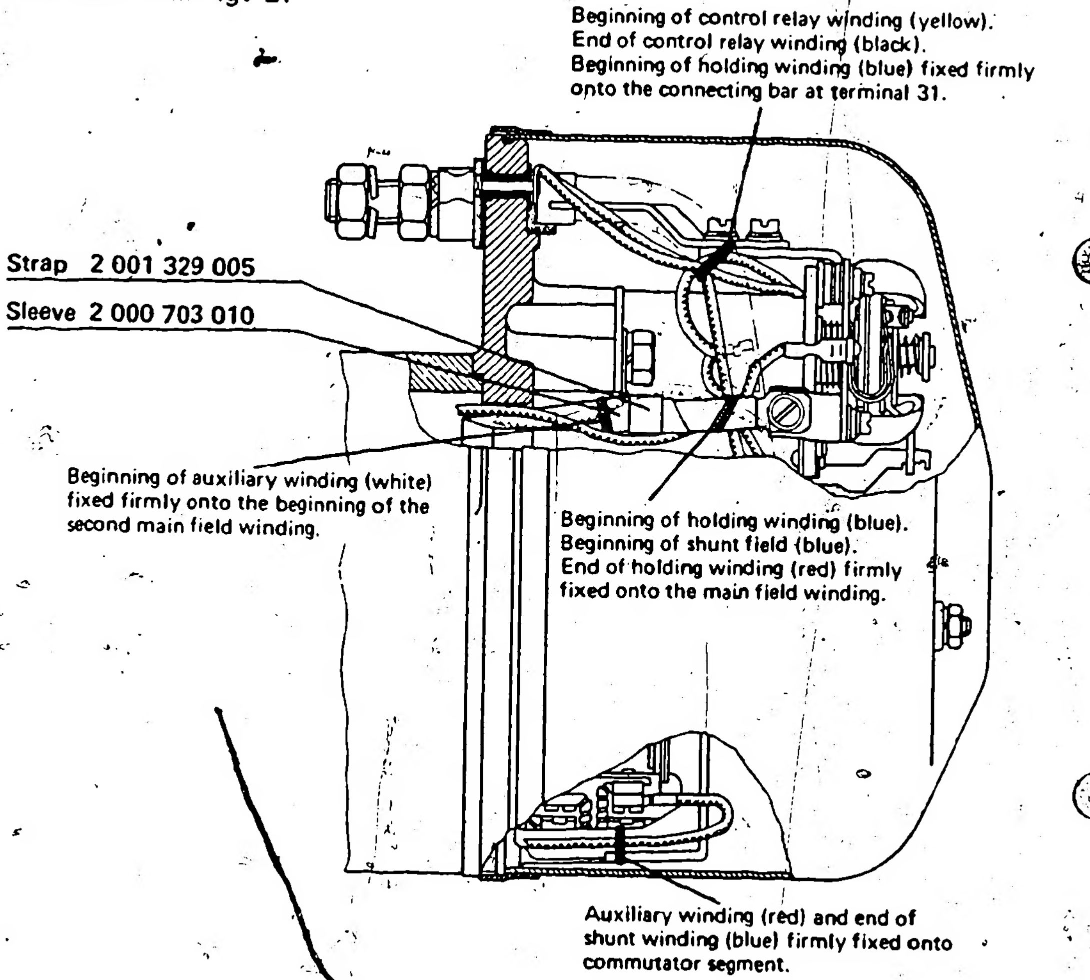


Fig. 2

4. Vibration-proof carbon brush set as from mid-1972

In order to increase the carbon brushes' resistance to vibration there has been a changeover to carbon brush set 2 007 014 017, consisting of 4 brushes, in place of set 2 007 014 014, consisting of 8.

5. New fastening of the bearing cap on the clutch housing

In some cases the bearing cap 2 005 826 058 (Pos. 62) has worked itself loose on the clutch housing of armature 2 004 006 101 (Pos. 60) and the pilot has thus become worn away, whereby the threaded holes have been destroyed, thus rendering the armature unusable.

N 27

5.1 As a remedy an additional pinned fitting with 4 slotted spring pins 2 917 760 095 has been introduced as from August 1974 (FD 428) to be used simultaneously together with four 4 mm longer fastening screws 2 911 071 158 (Fig. 3).

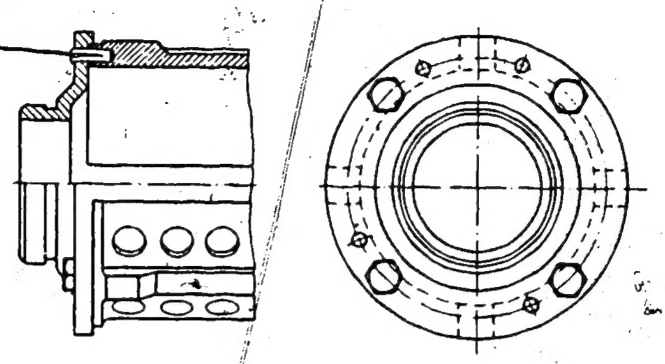


Fig. 3

The replacement armature 2 004 006 101 will continue to be delivered under the same Part Number. The bearing cap is fastened on the armature with the 4 screws and the slotted spring pins are only knocked into the bearing cap. After the drive spindle has been mounted the slotted spring pins must be knocked into the clutch housing before the hexagon screws are tightened up. In case of repair the slotted spring pins 2 917 760 095 must be renewed. The bearing cap and the armature are matched and bored together, and must not be interchanged. Tighten the fastening screws with 7 - 8 Nm (0.7 - 0.8 kgf·m) of torque. In order to prevent screws being overtightened or working loose, this torque must be strictly adhered to, since in this case no retainers or retaining plates 2 001 021 000 are used.

5.2 If a starting motor built before FD 428 is repaired and the armature is not exchanged, then the retaining plates must continue to be used.

Warranty procedure

If starting motors break down because of loose bearing caps on the clutch housing within 12 months of putting into operation, the repair can be carried out free of charge where the starting motor has not been in operation for more than 50,000 km. A condition of this fair-deal arrangement is that the starting motor be handed over to a Bosch Service in an unopened state with precise details of operating time and putting into service.

Please give 10 as the defect number.

In case of enquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich K 1
Abteilung VAK 6

N 28